FOUNDRY

EST. 1902 TRADE JOURNAL

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. III
No. 2326
JULY 6, 1961

Registered at the G.P.O. as a Newspaper

Offices: John Adam House, John Adam St., London, W.C.2

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- LONG LIFE, FLEXIBLE COMPENSATING PAD (DIAPHRAGM)
- MOULD HARDNESSES UP TO 100 (DIETERT)
- PRODUCTION UP TO 300/500 MOULDS PER HOUR
- PRECISION PATTERN DRAW
- NO JOLT OR VIBRATION
- DEEP, NARROW POCKETS OF UNIFORM HARDNESS (100 DIETERT)
- QUICK CHANGE PATTERN MECHANISM

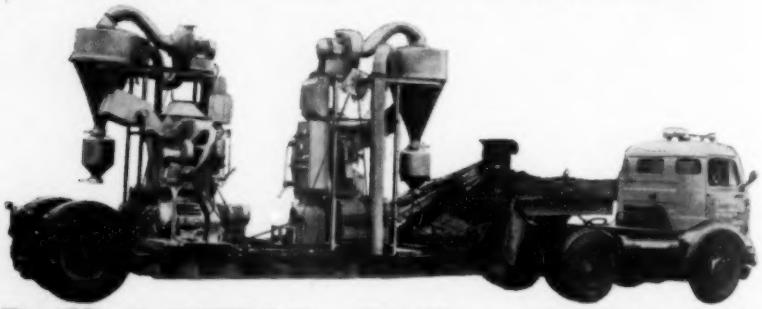
Baker Perkins Ltd.

Foundry Department,
Bedewell Division, Hebburn on Tyne.
Telephone No: Jarrow 897124

TWO MORE FORDATH COMPACT COATERS

Such was the reception of the new 150 Compact Coater at the Milan Foundry Exhibition last October, that even our highest hopes were surpassed.

Orders from Italy and elsewhere on the continent for this new "packaged deal" have proved conclusively that FORDATH have brought Shell Sand Coating within the reach of the smaller user, for Shell Mould and Shell Core operations. This new Coater can provide 2 tons of resin coated sand per 8 hour shift in 150 lb. batches. The unit is completely self-contained with integral electric heater, control panel with time-cycle selection and pneumatic sand loader, the only requirement at installation is the connection of air and electric power lines.



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For further details write to: The Fordath Engineering Co. Limited., Brandon Way, West Bromwich, Staffs, England. Telephone: West Bromwich 1665 (4 lines). Telegrams: Fordath Telex West Bromwich. Telex No.: 33415.

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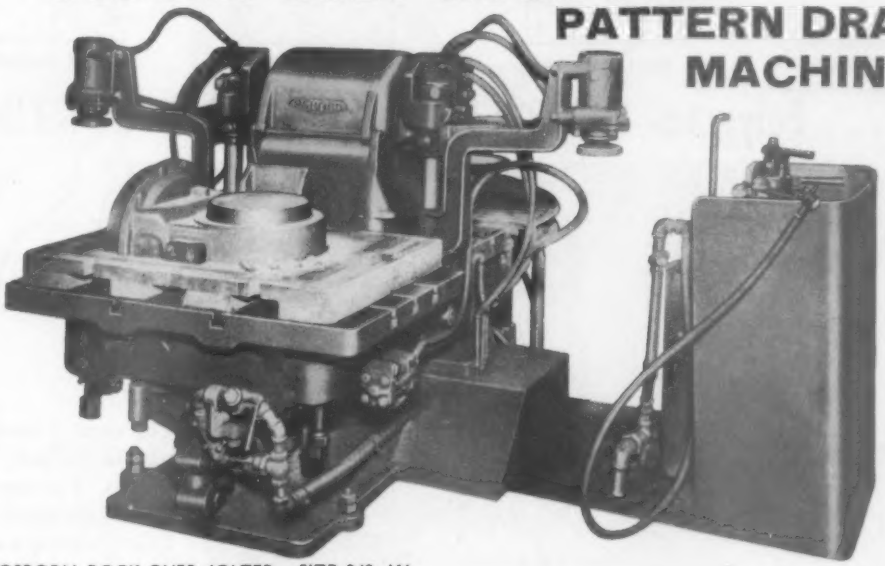
JACKMAN – BUILT

OSBORN JOLT ROCK-OVER PATTERN DRAW MACHINES



OSBORN ROCK-OVER JOLTER. SIZE 242. W.

	242 W. M/C	643 M/C
MAX. BOX DIMENSIONS OVERALL:—		
LENGTH	OPEN END	OPEN END
WIDTH	30″	38″
JOLT CAPACITY	1500 lbs.	2000 lbs.
TABLE SIZE	29″ x 42″	35″ x 50″
DRAW STROKE UP TO	19″	21″
COMBINED BOX SPACE & PATTERN DRAW	31″	33″

PNEUMATIC CLAMPS OPERATE IN TANDEM

OPEN ENDS PERMIT WIDE VARIATION OF BOX LENGTH

AIR CLAMPS LOCK LEVELLING MECHANISM WHICH TAKES CARE OF VARIATIONS IN BOTTOM BOARDS

AIR CONTROLLED PATTERN DRAW GIVES SLOW & FAST DRAW

CONVEYOR ROLLER ON LEVELLING MECHANISM CAN BE ARRANGED FOR ROLL-OUT EITHER ON CENTRE LINE OF MACHINE OR AT RIGHT ANGLES

'T' SLOTS ARE PROVIDED IN TABLE FOR QUICK PATTERN CHANGE

J. W. JACKMAN & COMPANY LIMITED

VULCAN WORKS · BLACKFRIARS ROAD · MANCHESTER 3

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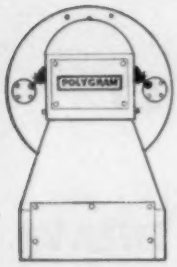
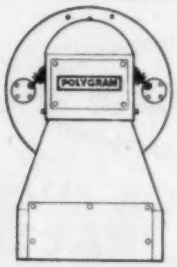
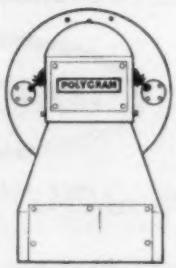


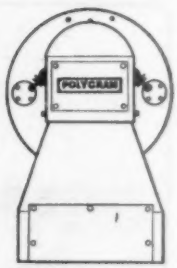
SHELL COREMAKING



SHELL MOULDING

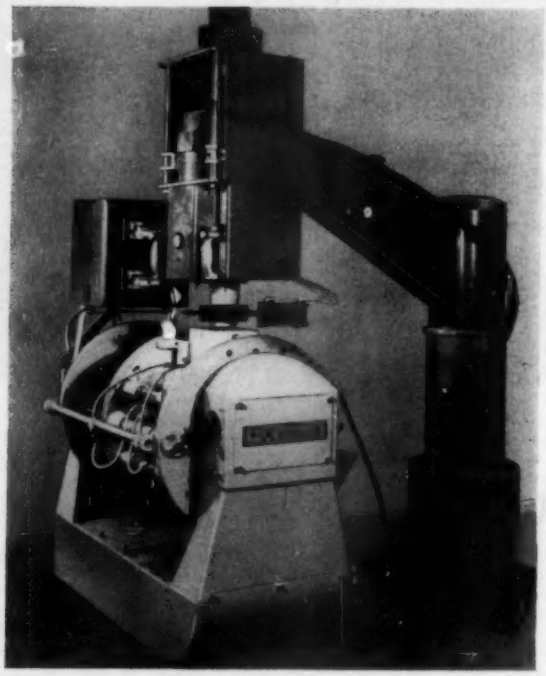


HOT-BOX PROCESS



GRAVITY DIECASTING

ONE . . . Polygram MANIPULATORS for SHELL COREMAKING



This shows a Manipulator in use with the latest Polygram column-mounted Coreblowing head.

Polygram Manipulators are the ideal method for handling large shell coreboxes (up to a maximum size of 28in. by 18in.) since they offer the following advantages:—

Full pneumatic operation from closing box to ejection of core.
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Temperature of each half of corebox electrically regulated within ±5°C.
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* *We won't bother you with the technical "gen" here, but just say the word and we will have a representative round with the milk in the morning.*

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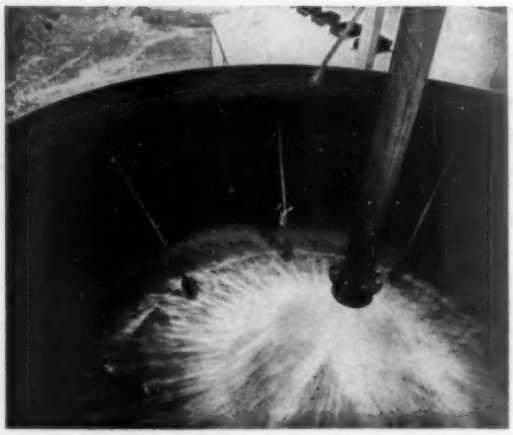
Roper

Because Roper productions are more than efficient they are reliable in operation

Illustration on left, a Wet type Spark Arrester with Inspection Platform serving a 17 ton per hour Cupola.



At right is shown Spark and Dust Suppressor with a Spray Jet giving a double water curtain.

E. A. ROPER & CO. LTD

Photographs by courtesy of BILSTON FOUNDRIES LTD.

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KEIGHLEY YORKSHIRE
Tel: Keighley 4215/6 Grams: "Climax" Keighley

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WET SCRUBBING will reclaim used sand in condition equal to new

you can now save hundreds of £'s

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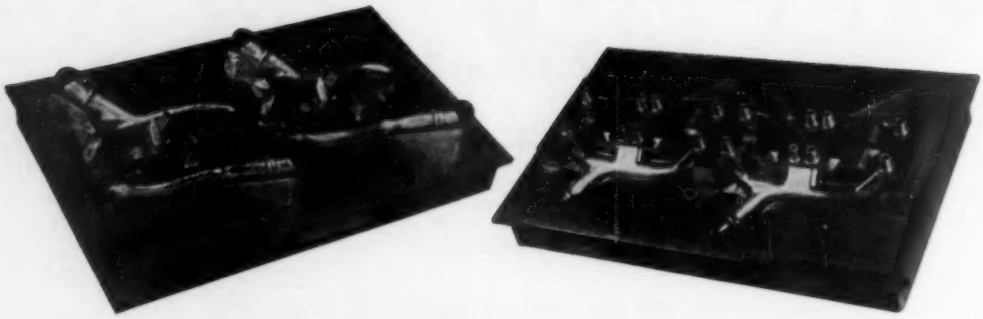

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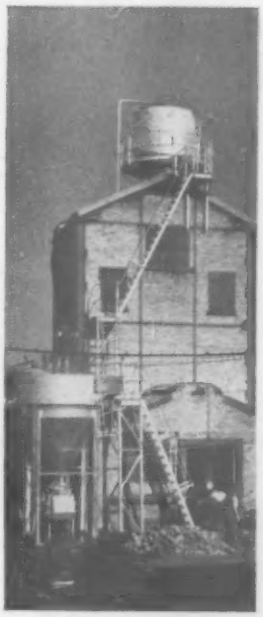
Coarse as grit . . . fine as fume; if you want to control it, collect it, separate it, extract it, the people to get in touch with are Filter-Heat Ltd.

WHY?

For a very sound reason. They are not committed to any particular *method* of dust collection but are concerned with one thing only—the best way to trap a particular type of particle. It might be done with cyclones or multi-cyclones, cloth filters, wet collectors or reverse-jet filters —or a combination of these. Filter-Heat make them all. But for cupola emission they would install their water screen grit and spark arrester, similar to the one illustrated which is shown complete with its specially designed settling tank. They have also considerable experience in the design of hoods for the control and collection of industrial fumes, dust and grit. If you have a dust or grit problem ring them up—at Rugeley 138; Leigh, Lancs 72101 or (London) Abbey 3085. The name is . . .



The photograph shows a Filter-Heat grit and spark arrester which was recently installed in the Midlands.

FILTER-HEAT LTD

(a subsidiary of Sutcliffe, Speakman & Co. Ltd.)

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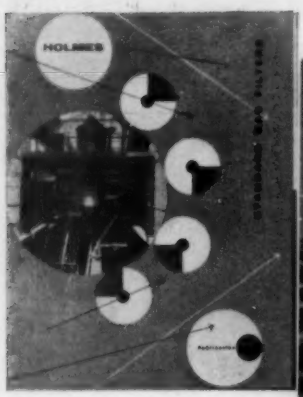
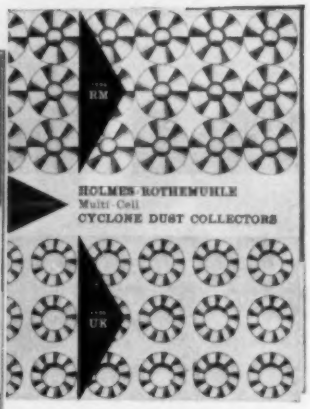
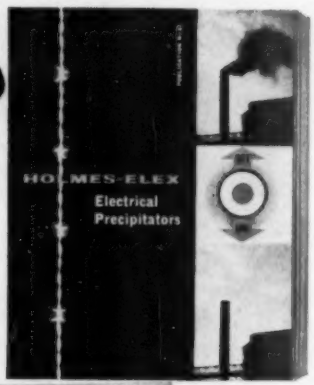


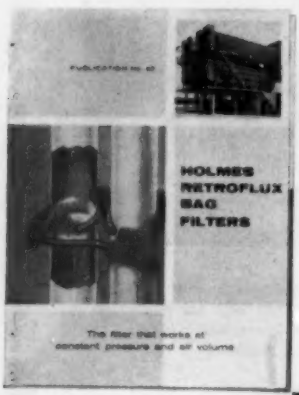


Which?



Which type of dust collection and control plant is most suitable, both technically and economically, for your particular application? A complete answer to this question lies within the pages of the various brochures illustrated. Have these brochures before you when you decide.

Ask for technical literature GCD/23



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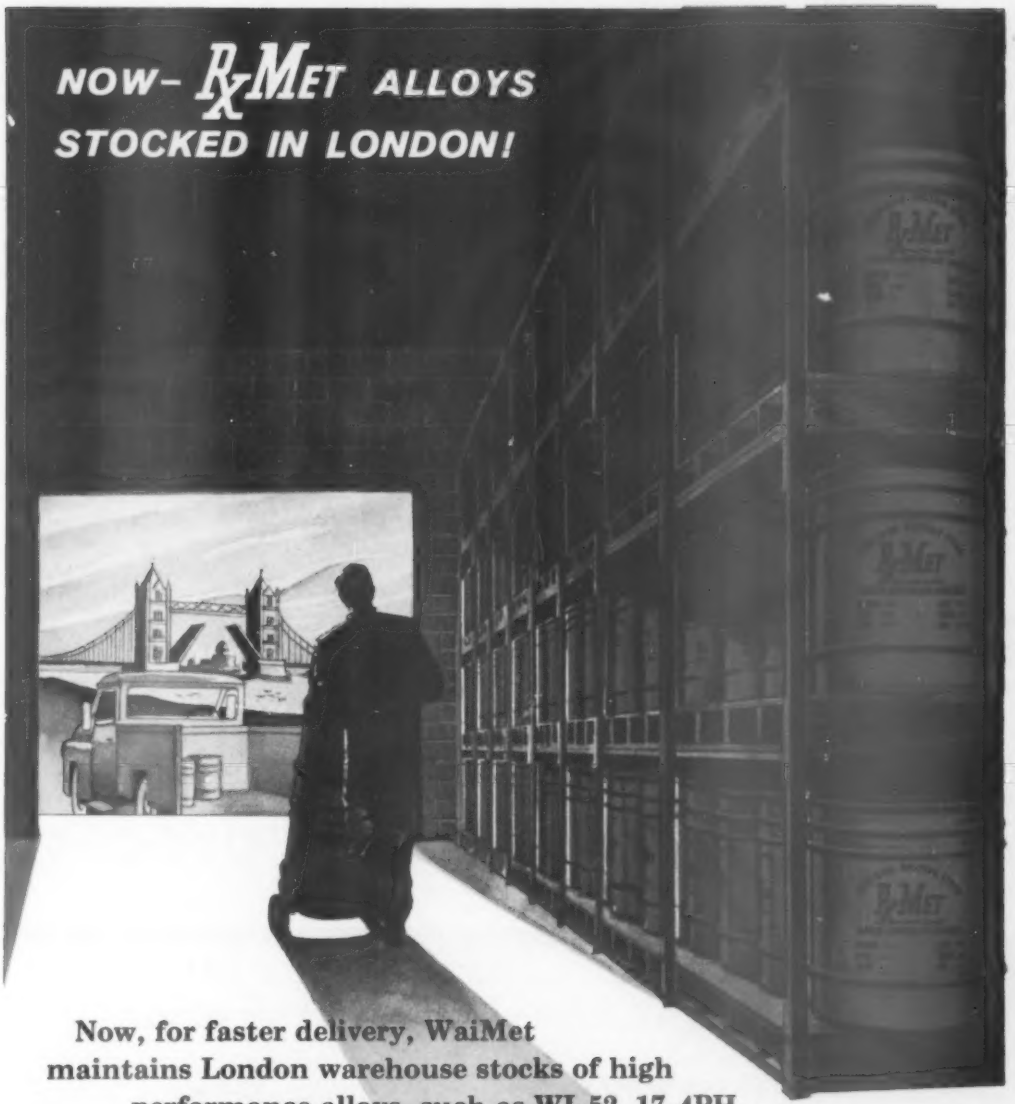

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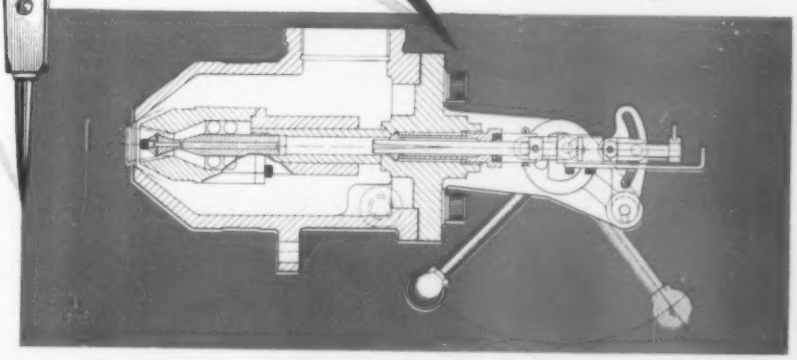

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LIMITED
at
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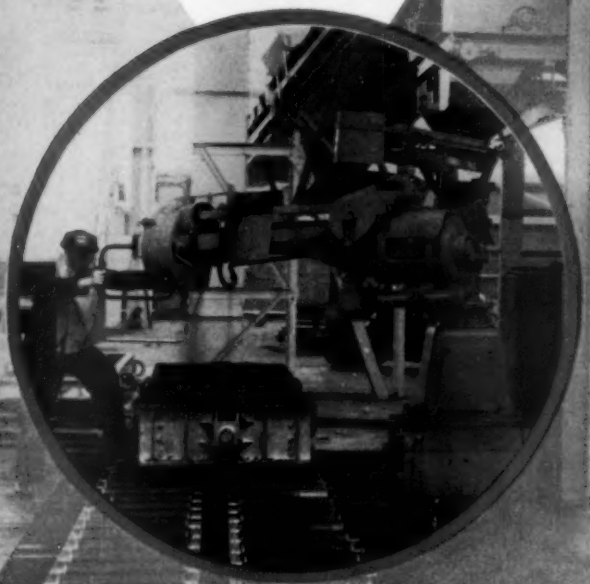

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A full range of grinding wheels and Rotobrushes to suit a wide variety of working conditions is available.
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Reciprocating pneumatic tools for foundry use are also made by HOLMAN. HOLMAN Chipping Hammers are unsurpassed for low air consumption and exceptional power.
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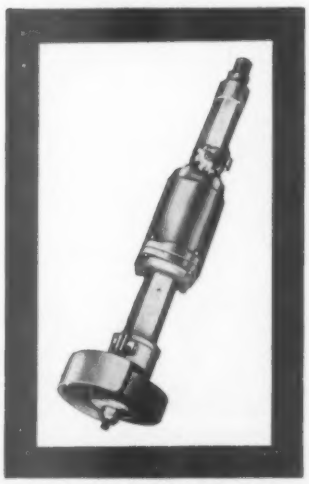

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MOULDING BOX BUSHES

can save you money in six ways all at the same time.

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5. **RADIUSED LEAD-IN** — Speeds up insertion.
6. **AVAILABILITY** — All standard sizes in stock.

It pays to bush with

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BUSHES

Save scrap!

BRITISH AERO COMPONENTS LTD., MONTAGUE ROAD, WARWICK. TELEPHONE 320

★ These machines embody either the B.S.C.R.A. or the B.C.I.R.A. Patent Systems of Dust Control and comply with the new Government Regulation 1 of the Grinding of Metals (Misc. Indus.) Regulations, and Regulation 7, para. (6) of the Iron and Steel Foundries Regulations, 1953.

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FLOOR GRINDERS

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★ **Separate driving motors provide independent drive and control to each wheel.**

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★ **Totally enclosed motors avoid electrical breakdown.**

★ **Short oversize spindles give maximum rigidity.**

★ **Precision pre-loaded A.C. and roller bearings, allied with sturdy all-steel construction give longest life and smoothest running, and maximum wheel performance.**

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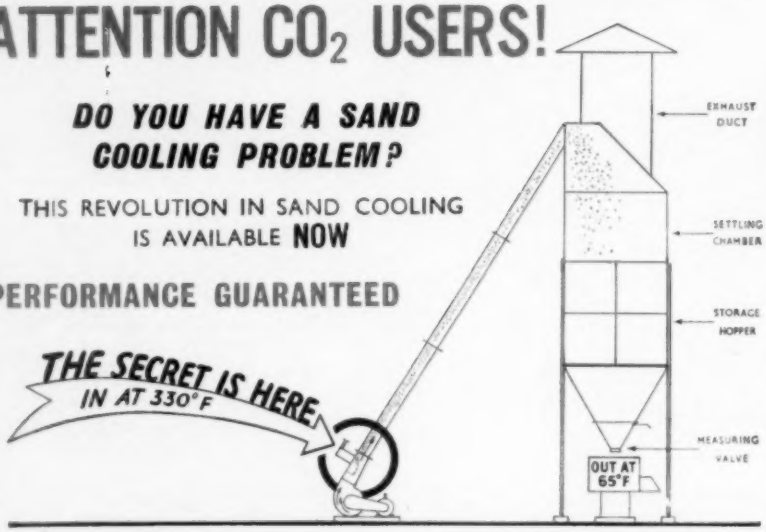
DO YOU HAVE A SAND COOLING PROBLEM?

THIS REVOLUTION IN SAND COOLING IS AVAILABLE **NOW**

PERFORMANCE GUARANTEED



- THIS AMAZINGLY SIMPLE AND HIGHLY EFFICIENT PLANT NOT ONLY COOLS BUT IN DOING SO ELEVATES THE SAND AND DEPOSITS IT IN A HOPPER IMMEDIATELY ABOVE THE MIXER READY FOR USE
- THE FLOW IS CONTINUOUS AND UNIFORM IN QUANTITY AND TEMPERATURE
- RUNNING COSTS ARE LIMITED TO THAT OF A SMALL FAN MOTOR
- MAINTENANCE IS NEGLIGIBLE
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- IN THE EVENT OF STOPPAGE – NO SUN BACK INTO FAN

PAT. APPLIED FOR

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Designed to enable the correct periphery cutting speed to be maintained, and allow each wheel to operate independently, thus one wheel only need be used or alternatively both wheels can be used at different speeds simultaneously.

Size of Grinding Wheels	—	20" × 3" × 7"
Speed of Motors	—	1400 r.p.m.
Speed of Spindles	—	1100 & 1250 r.p.m.
Distance between wheel centres	—	5' 0".
H.P. of Motors (2)	—	4.

SAFETY DEVICE TO PREVENT HIGH SPEED BEING ENGAGED WITH A NEW WHEEL

20" MODEL

illustrated fitted with B.C.I.R.A. Hoods.

Also manufacturers of 10" 12" 14" and 16" Grinders and 9" Power Hacksawing Machine.

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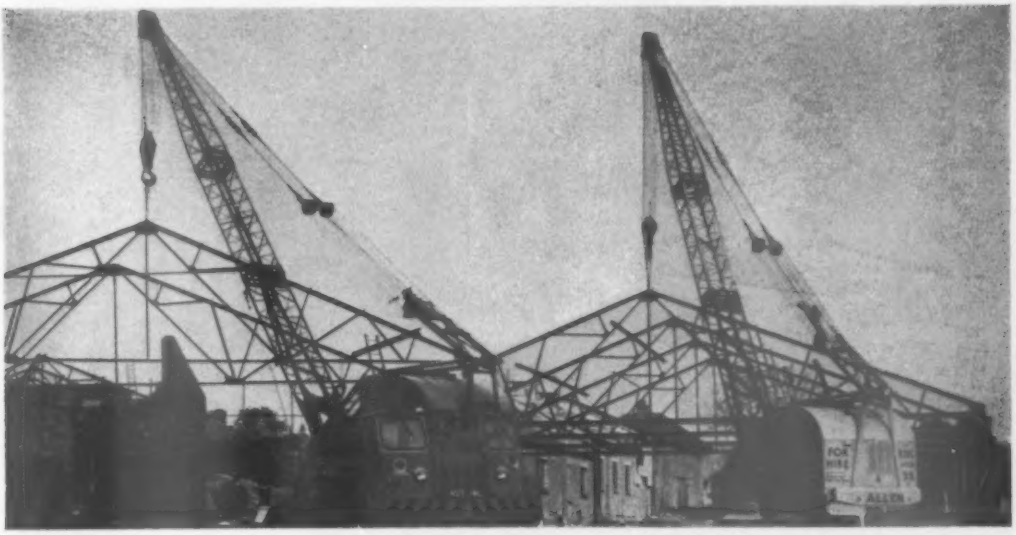
WE ALSO HAVE SPACE PROBLEMS!

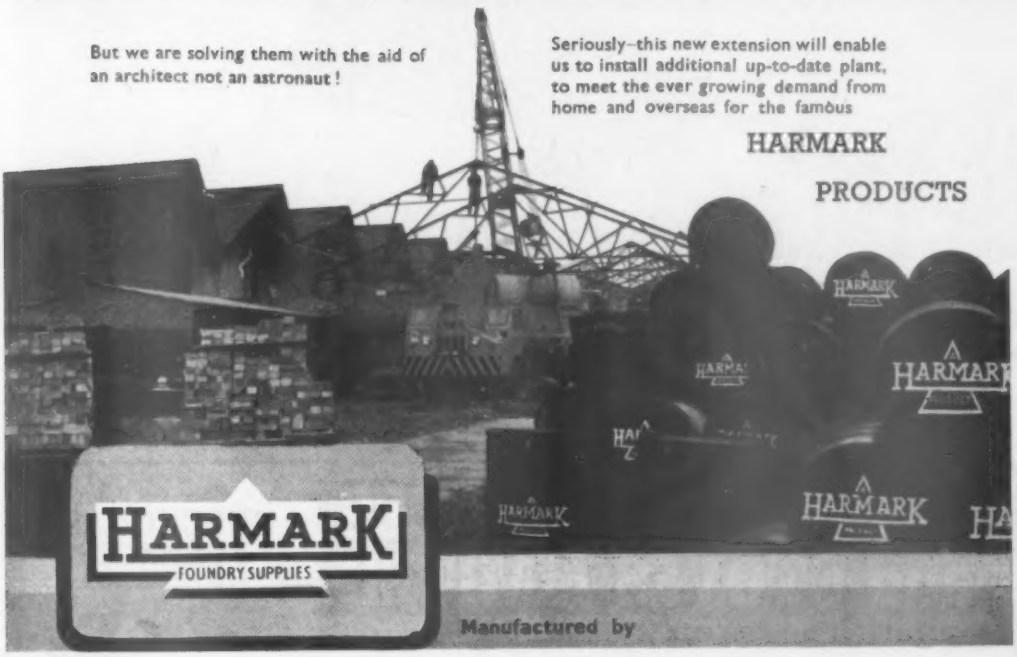


But we are solving them with the aid of an architect not an astronaut!

Seriously–this new extension will enable us to install additional up-to-date plant, to meet the ever growing demand from home and overseas for the famous

HARMARK

PRODUCTS



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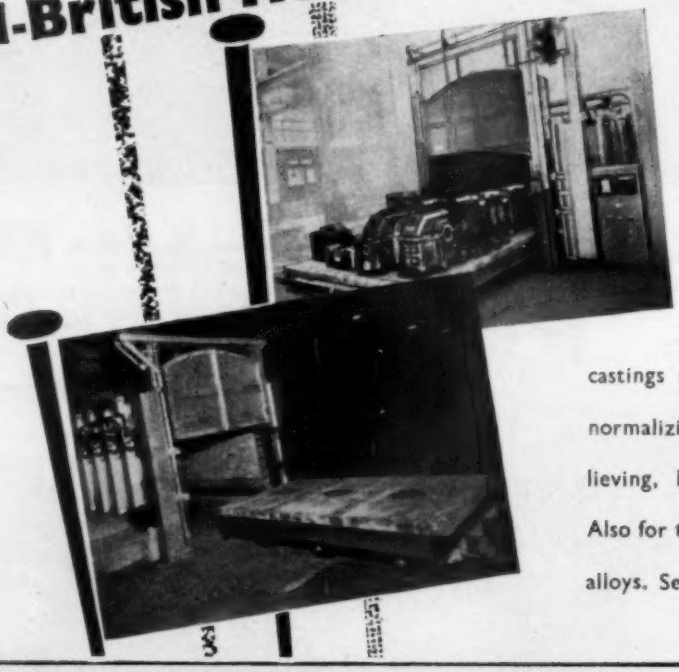
HARBOROUGH CONSTRUCTION CO·LTD·MARKET HARBOROUGH

All-British Heat Treatment Furnaces



'NEWSTAD' heat treatment furnaces are ahead in design and performance. Suitable for S. G. Irons, and for the treatment of steel castings and forgings. Furnaces for normalizing, annealing, stress relieving, hardening and tempering. Also for the heat treatment of light alloys. Send for further information.

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8/219

INSTRUMENTATION SOLVES A FOUNDRY PROBLEM

Difficulties which hampered production at this foundry of Geo. Salter Ltd., West Bromwich have been completely overcome by the introduction of John Thompson Cupola Meters. Information provided by the instruments, has cut costs, direct and indirect, production has increased and maintenance reduced.

John Thompson Cupola Meters can do the same for you.

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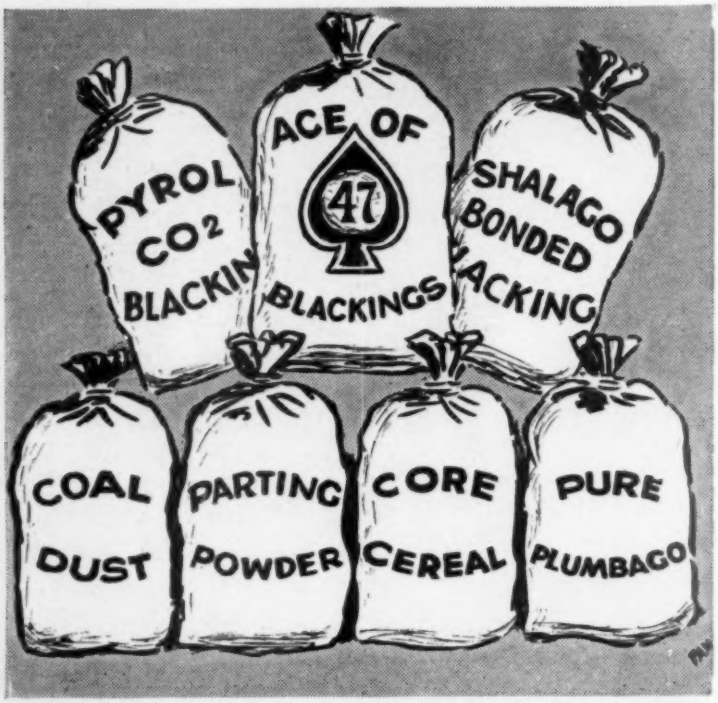

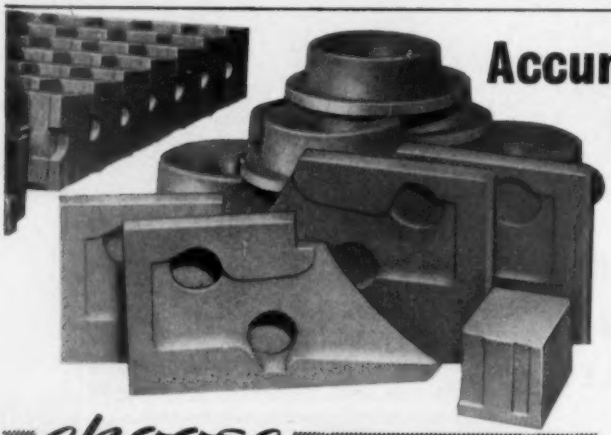

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Refined Cold Blast PIG IRON

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FOR HIGH DUTY CASTINGS

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In 15 ton casts direct from receiver to required analysis

Castings made from these irons have greater density and toughness. You will have fewer rejections, greater freedom from cracks, breaks and other defects.

SPECIAL NICKEL & CHROME ALLOYS

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bench has proved itself to be an effective solution of that problem.

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For melting Aluminium, Brass, Copper and soft metals

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CAPACITY LBS. ALUMINIUM	100	200	300	400	1000
DIAMETER "A"	2'9"	3'0"	3'3½"	3'3½"	4'9"
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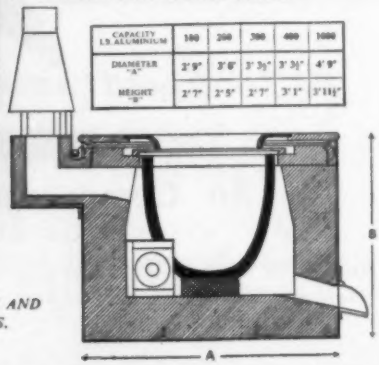

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	Total Carbon	3·4% min.
	Silicon	2·0—4·5% (in ranges of ·5%)
	Manganese	0·7—1·1%
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A free and confidential metallurgical service is offered to customers in all aspects of foundry practice and technique.

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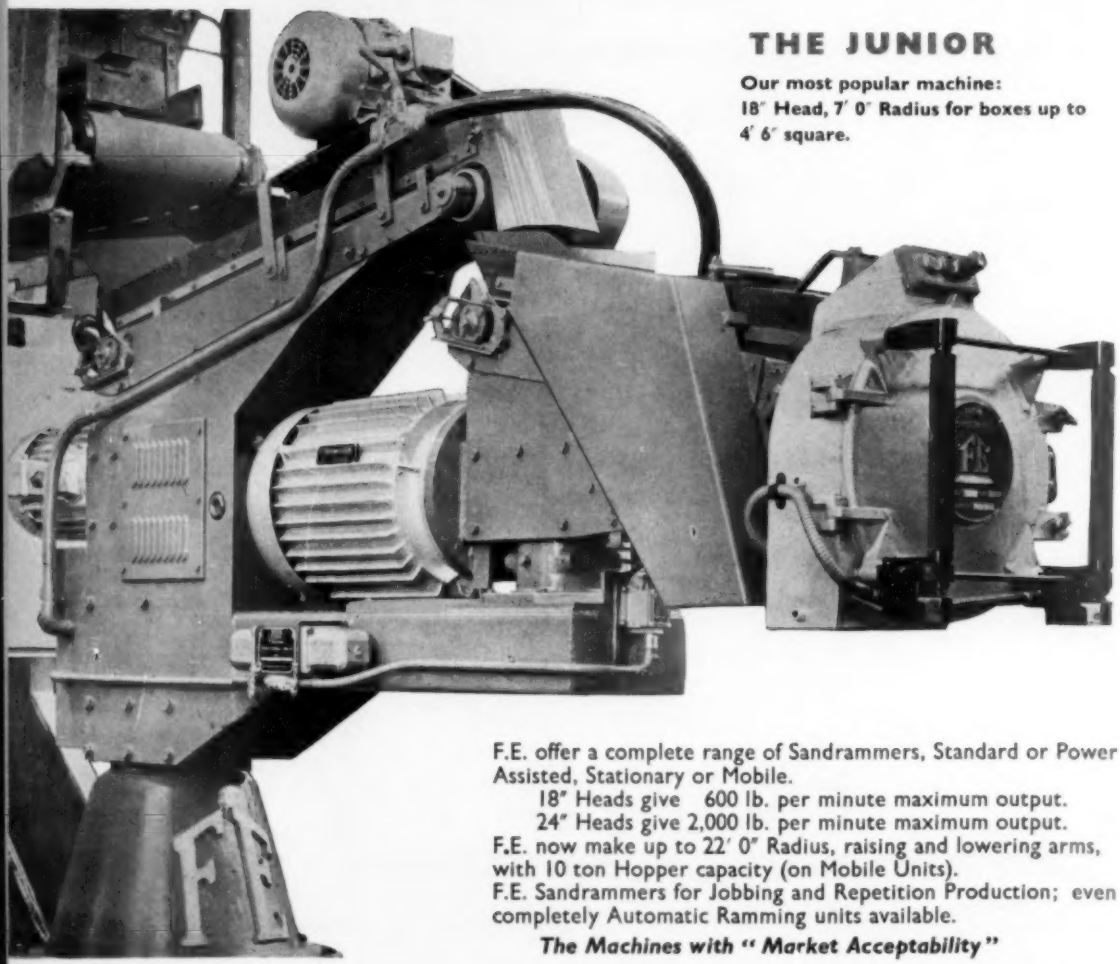

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18" Head, 7' 0" Radius for boxes up to 4' 6" square.

F.E. offer a complete range of Sandrammers, Standard or Power Assisted, Stationary or Mobile.

18" Heads give 600 lb. per minute maximum output.
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F.E. Sandrammers for Jobbing and Repetition Production; even completely Automatic Ramming units available.

The Machines with "Market Acceptability"

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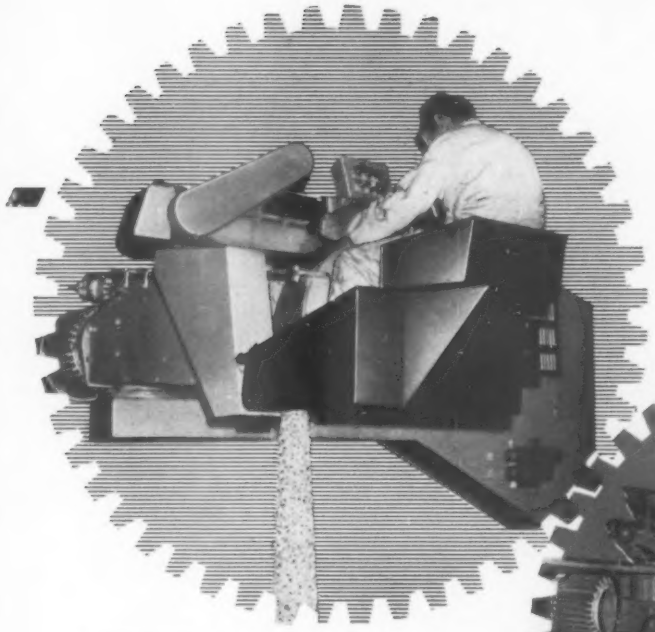
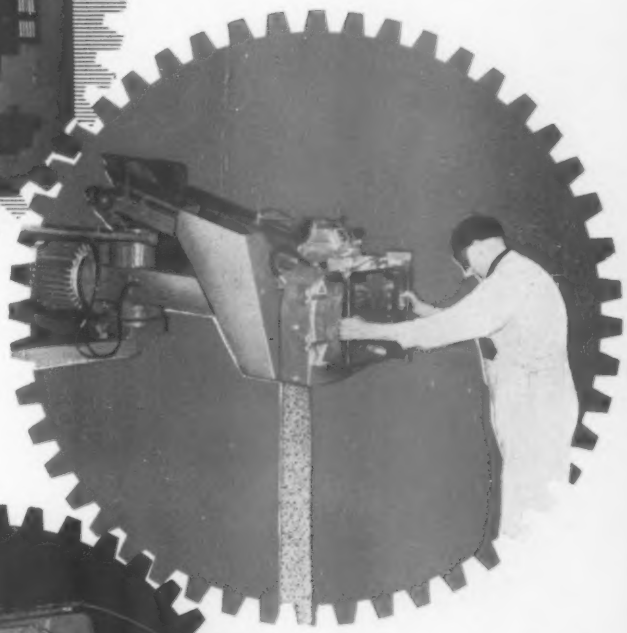


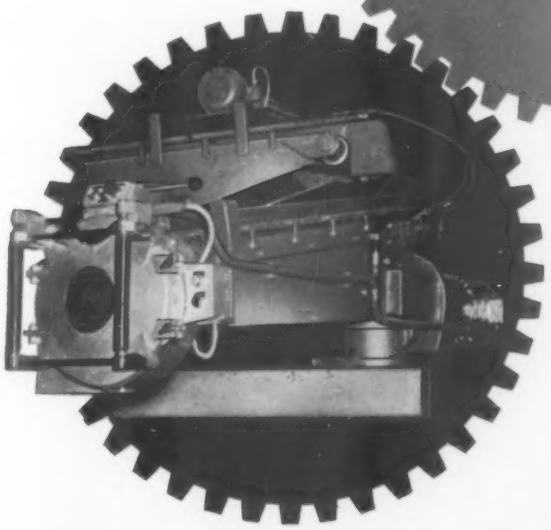
SENIOR No. 4

This is High Output Mobile Sandrammer, but Stationary model available: 24″ Head, 15′ 0″ Radius for boxes up to 10′ 0″ square.



SENIOR No. 1

The middle size machine, most suitable for jobbing work: 18″ Head, 10′ 0″ Radius for boxes up to 6′ 6″ square.



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Stationary Remote Control model for intermittent production of large boxes: 18″ Head, 15′ 0″ Radius for boxes up to 10′ 0″ square.

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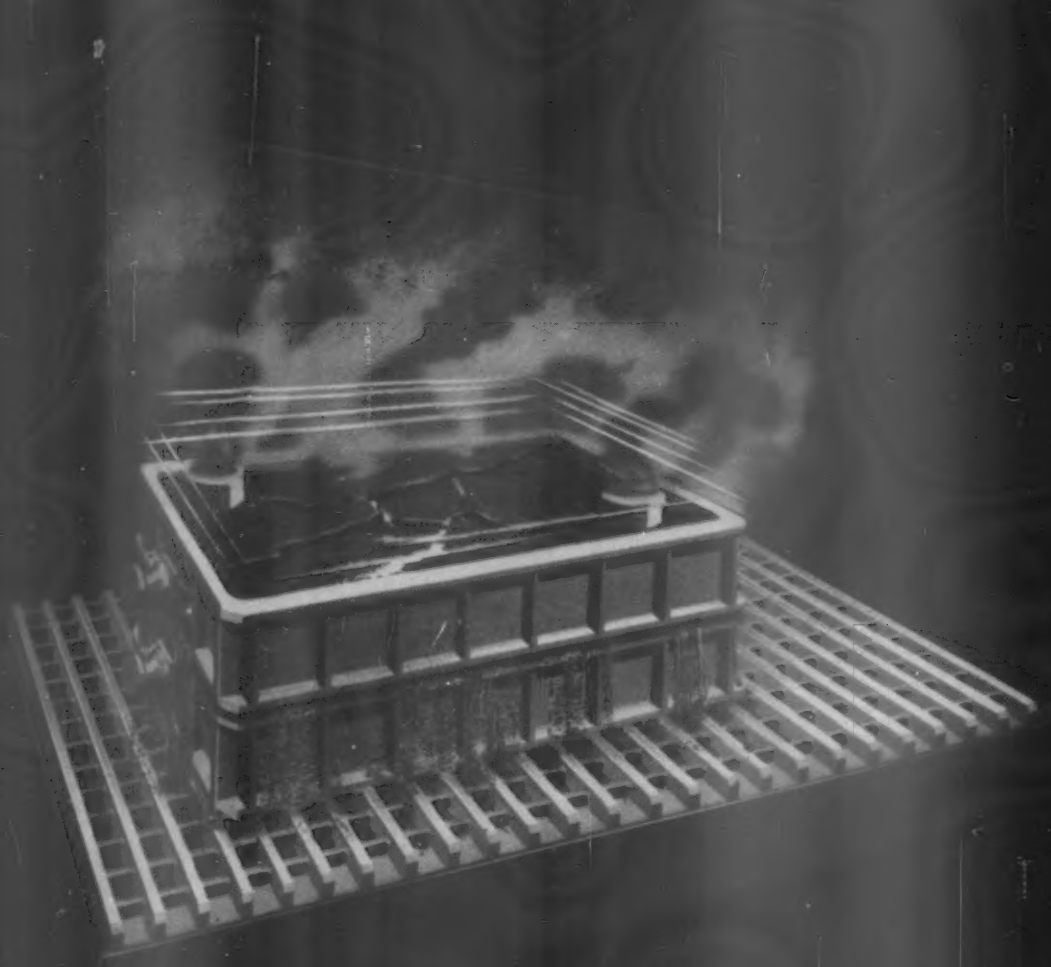

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MOULDING BOXES & SHAKE-OUT MACHINES

in use in more than 9000 foundries

throughout the world

STERLING FOUNDRY SPECIALTIES LIMITED, BEDFORD, ENGLAND

P.T.O.

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Sterling
MOULDING BOXES

made from the world-famous Sterling Heavy Duty Section

STYLE DF-YY (*right*) This box is made from 'Sterling' heavy duty section with 1 in. wide flanges and ⅜ in. thick walls. The box shown has no bars and the lugs are for loose pin closing. It has flanges at each face. If bars are required the back flange is usually omitted (Style DF-Y).

* This section also contains copper and a higher percentage of carbon.

The centre illustration shows a 4 parted box with bars, heavy handles for crane or manual lifting, and clamping bars with clamps.

STYLE DFT-YY (*below*) Shows a 3-parted box, 4 ft. square. It is for dry sand work in a steel foundry and is therefore strongly reinforced to withstand a rough knock-out.

Sterling MOULDING BOXES

STERLING FOUNDRY SPECIALTIES LTD. BEDFORD, ENGLAND

619 Cogent

FOCUS ON 'FULBOND'

No 2 Bond Development

FULBOND combines rapid bond development and high initial strength enabling moulding sands to be prepared quickly and economically. In addition, the use of FULBOND gives the technical advantages of increased flexibility, wider control and a much more resilient sand.

Where Milling Time Can Be Varied

When a sand mix is milled the strength increases rapidly at first then more gradually until finally no further increase in strength will be obtained. Additions of FULBOND will ensure that optimum bond strength is developed in the shortest possible time. This will eliminate any undeveloped clay in the sand avoiding the bad effects of excess clay and also increasing the output of milled sand to the maximum possible.

Where Milling Time Is Fixed

In mechanised foundries using continuous mills or where, due to the demand for sand, milling time is limited, only a fixed short time can be given. Undeveloped clay will therefore be present, this being wasteful and requiring extra moisture which reduces permeability. FULBOND will keep the content of undeveloped clay to a minimum.

Advantages can also be obtained by using FULBOND in unmilled sands prepared on the foundry floor.

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Investigate these NEW

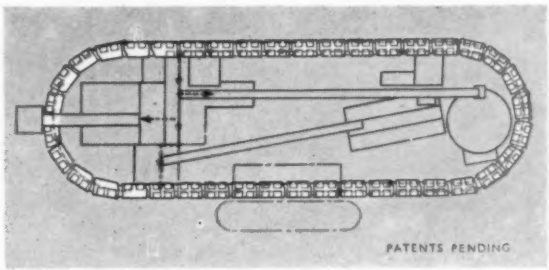
BARTLETT-SNOW
CLEVELAND 5, OHIO

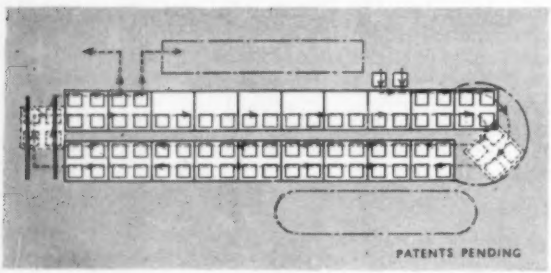
Mould Handling Systems

Unique and Practical

"Double MLC" Mould Handling System

Snap or tight flask moulds are set out in outside position on the car, poured, and travel almost completely around the loop. They are then transferred automatically to inside position on the car, and continue around the loop again for automatic removal at the shakeout. These new systems provide almost twice the cooling time of a conventional mould conveyor carrying only a single line of moulds; effecting substantial savings in floor space, equipment, building, and other facilities.



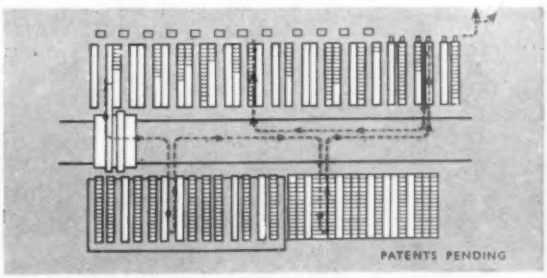


"Double MRI" Mould Handling System

Rectangular loop, consisting of two straight runs connected with a rotary turn and transfer car. Cars advance one car length, then remain stationary for timed period so large moulds can be loaded onto the conveyor, poured, and the moulds removed, while the conveyor is stationary. Moulds are carried side by side on the cars and make almost two complete trips around the loop, thus nearly doubling the cooling time per square foot of floor space.

"MF" Mould Handling System

Unlimited flexibility for jobbing foundries. The transfer car delivers pallets loaded with similar moulds, to the pouring, cooling, and shakeout zones, and returns the pallet with the bottom boards and bands—or flasks—to the moulding area. Handling similar moulds together permits moulds for different castings to be kept separate, and even poured with different metals, without interfering with other groups of castings. Slow jobs do not hold up the fast jobs. Moulding, pouring, cooling and shakeout are centralized, minimizing the equipment requirement.



Write today for a copy of Bulletin No. 135. It gives full details about eight different types of Bartlett-Snow Mould Handling Systems.

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ACME CONVEYORS LTD

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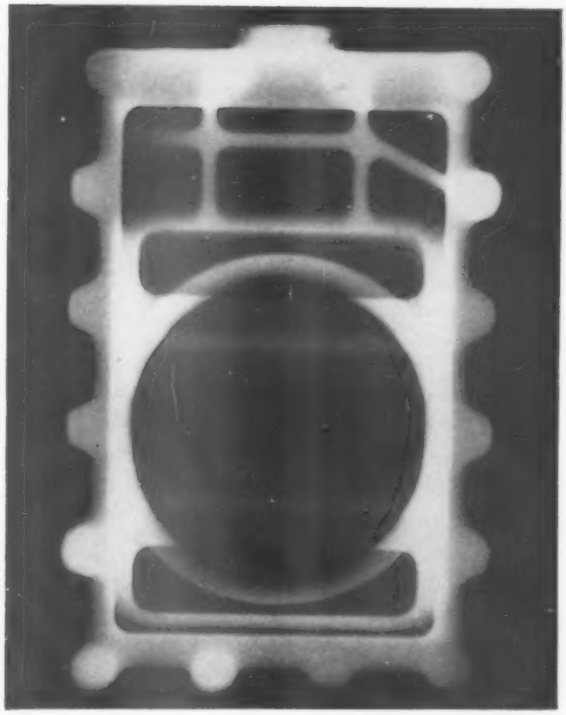

Where sections vary greatly . . .

. . . 2 films are better than 1

ILFORD technicians pioneered multiple film technique in industrial radiography. This has been graphically described as a "sandwich" of two or more films, and the technique gives vastly superior results where specimens with widely varying densities have to be critically examined.

The "sandwich" consists of two or more films of different speeds loaded into a standard cassette for simultaneous exposure. Thick sections of the specimen register clearly on the faster film, and the thinner sections on the slower film. The effects of differential exposure can be accentuated by using lead screens in the "sandwich". The technique can also be used for making duplicate radiographs by using two films of the same speed.

Choice of the appropriate ILFORD Industrial X-ray films obviously depends on the subject, the tube voltage and the presence or absence of screens. Full details of film choice and voltages, as well as lead screens, will be forwarded by request.

For improved radiographic examination

ILFORD INDUSTRIAL X-RAY FILMS, CHEMICALS, CASSETTES AND LEAD SCREENS

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Solve the Problem

This company produces a diversity of castings in alloy iron and hematite iron. These include ingot moulds for the steel industry, brake drums and liners for Public Passenger vehicles, machine tool castings, gear wheel blanks, Colliery castings and General Engineering castings. The problem here was to find a suitable Shot Blast Machine to clean castings from one pound to two tons at lowest total cost and to speed production.

for **ALLOY STEEL & IRON CO · CHESTERFIELD & SHEFFIELD**

THE SOLUTION . . .

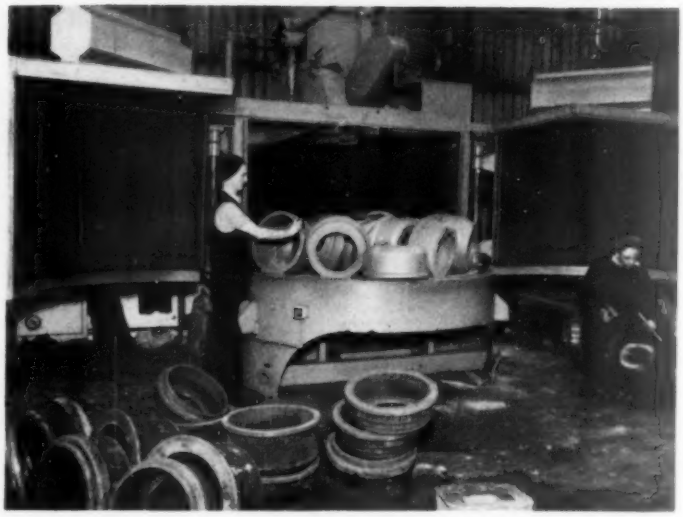
After seeing the Pangborn LK 6ft. Rotablast at the 1958 Foundry Exhibition they decided to instal this machine to replace an Airless Rotary Barrel which was limited to size and weight of castings it was able to clean.

●

THE RESULTS . . .

1 Machine easily installed.
2 No Foundations required.
3 All Castings produced are now cleaned by machine.
4 50 per cent. increase in Output is now cleaned by same number of operatives.
5 No Breakages of Thin Castings.
6 Considerable saving of shot.
7 Fettling keeps pace with output.
8 Perfectly clean Castings to customers on time.

Blasting time three minutes



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USE BQ Automatic Machines

in their mechanised foundries at Tipton Staffs.

B.Q.3 and B.Q.5 machines are making their contribution to the production of clean, dimensionally accurate castings in this famous foundry by providing clean, hard and accurate moulds.

B.Q. machines are available in 3 sizes and various types of pattern draw.

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BRITISH MOULDING MACHINE CO. LTD.

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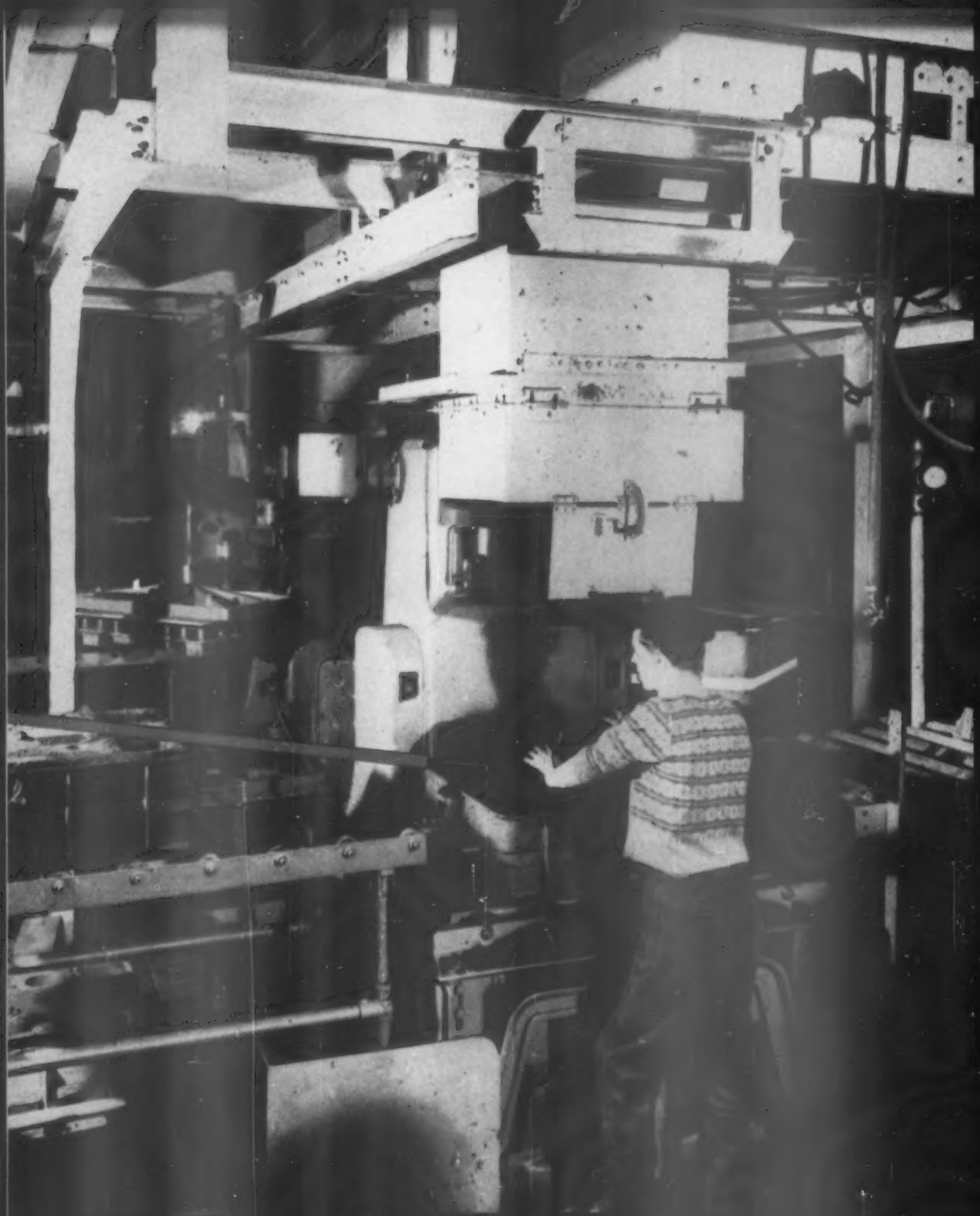

WESTON WORKS - FAVERSHAM - KENT

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Fifteenth century carving of a sow and litter in Wrexham Parish Church. Photograph by Ruth Meyler & F. C. Sillar

50 MILLION PIGS GO TO MARKET!

In the early days of the industrial revolution manufacturers frequently looked for familiar and easily recognisable descriptions of their products. To the countryman transplanted into industrial surroundings nothing was more familiar than a pig; a fact which is emphasised by carvings in scores of old churches depicting pigs suckling their litter, rooting for acorns and playing the bagpipes. (Apparently this last pastime was forsworn by pigs many years ago because of unpleasant associations between bagpipes and pigs bladders.) Consequently, when iron from Blast Furnaces was directed into long troughs and from there into short and narrow troughs placed at right angles, a resemblance to sows suckling their appendaged litter led to the description of 'pig iron'.

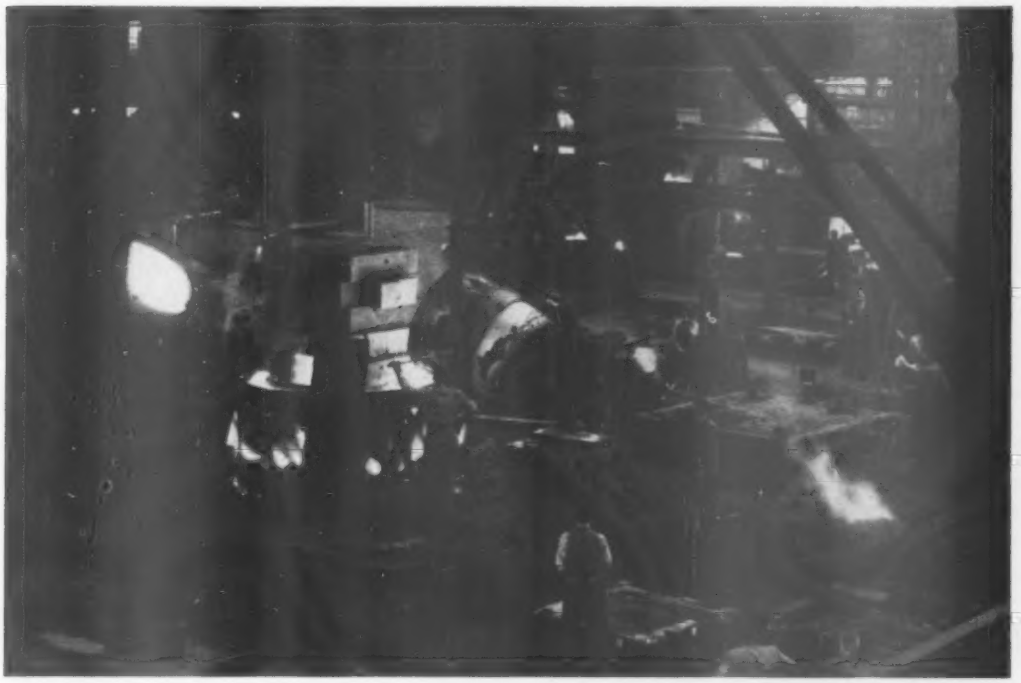
This series of advertisements illustrates some of the 'ecclesiastical' pigs and emphasises the 50,000,000 'special' pigs which Warner and Company have supplied to Iron Foundries producing High Duty Castings.

WARNER WARNER WARNER

"Pioneers of Refined Pigiron"

KA WARNER & CO. LTD., MIDDLESBROUGH

FOUNDRY MECHANISATION



SPECIALISED PLANT FOR FOUNDRIES IS DESIGNED SUPPLIED AND INSTALLED BY IC TO MEET THE INCREASING NEED FOR ECONOMY AND EFFICIENCY

- Cupola Charging — mechanical handling systems for all the ingredients used in charging including systematic weighing.
- Treatment and distribution of sand.
- Moulding and Coremaking Equipment.
- Fettling systems and hydraulic cleaning of castings.
- Complete Mechanised Plants.
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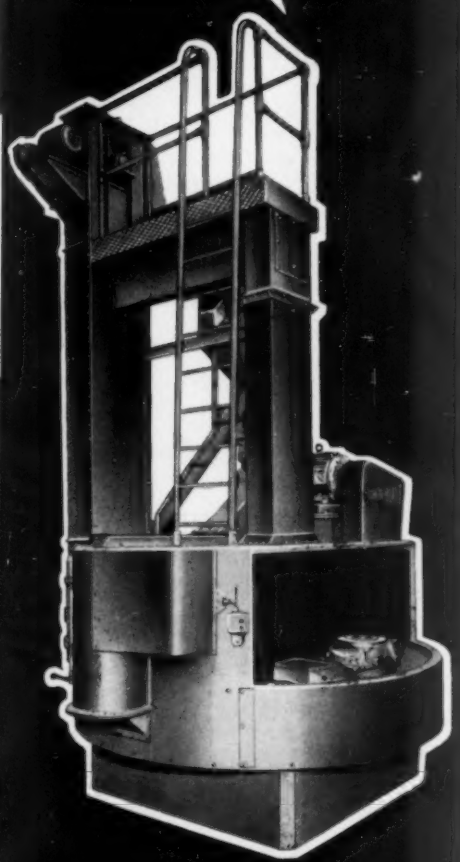
TGA MH28

A BLAST CLEANING MACHINE THAT'S A GLUTTON FOR WORK . . . .

THE 7' 6" DIAMETER ROTARY TABLE

CENTRIBLAST

IT'S AIRLESS, PITLESS, DUSTLESS



THE CENTRIBLAST EXCELS IN A GREAT VARIETY OF WORK

INCLUDING

- *Flat or pocketed castings of a type which must be turned 360° to ensure complete exposure to all surfaces and which would be damaged by a "barreling" action.*
- *Descaling of forgings, pressings and fabrications.*
- *Surface preparation of a wide variety of metallic surfaces for enamelling or painting.*
- *Cleaning of threaded articles prior to metallising or reclamation for re-use.*

In design, construction and appearance this machine is very much in advance of its contemporaries. Simplicity is the keynote and the result is an efficient economical unit easily maintained and capable of sustained hard work over long periods.

NO PIT IS REQUIRED.

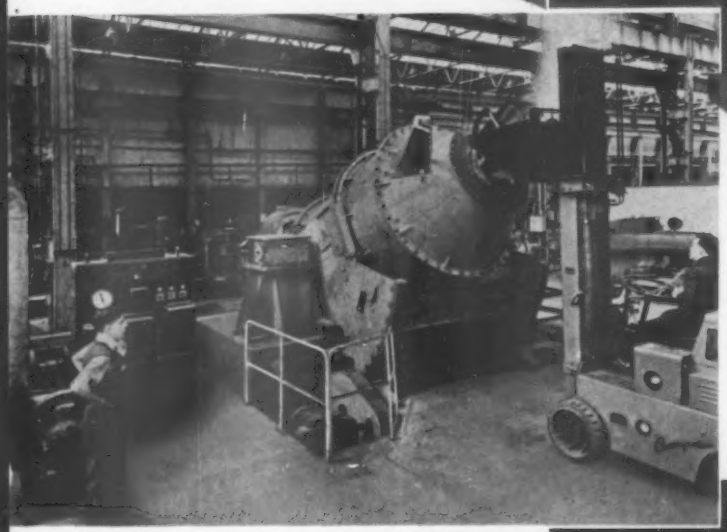
SPENCER & HALSTEAD LTD Blast Cleaning Division Ossett Yorkshire

Powney S. 36

ROTARY FURNACES

FOR MALLEABLE IRONS

AT LOWEST PRODUCTION COST PER TON



Tilting Type Rotary furnace reduces time and labour for charging. The furnace may be tilted to a vertical position for relining.

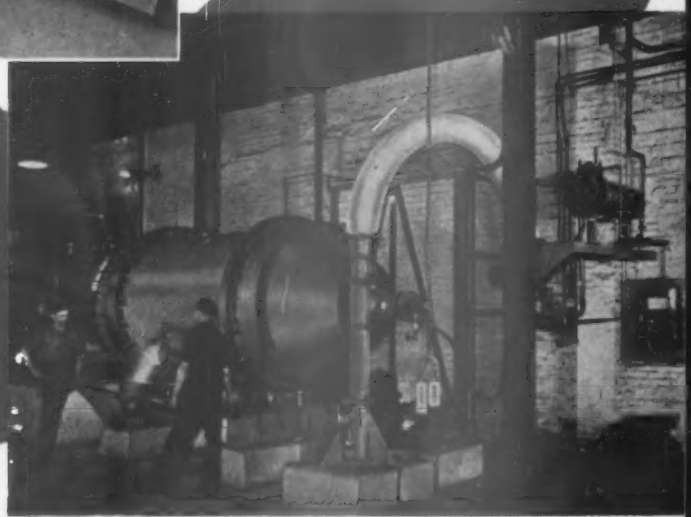
Furnace Capacities up to 10 Tons

AUTOMATIC COMBUSTION CONTROL EQUIPMENT

THIS HIGHLY DEVELOPED SYSTEM CONTROLS OIL AND AIR BY WEIGHT AND AUTOMATICALLY COMPENSATES FOR DIFFERENCES IN BAROMETRIC PRESSURE AND TEMPERATURE THUS ENABLING ANALYSES TO BE ACCURATELY FORECAST AND MAINTAINED WITH MELTING LOSSES REDUCED TO AN ABSOLUTE MINIMUM.

ADVANTAGES OF THE OIL-FIRED ROTARY FURNACE

- Ability to superheat to very high temperatures.
- Rapid melting.
- Flexibility of production.
- Simplicity of operation.
- High thermal efficiency.
- Minimum Maintenance and Labour.



MONOMETER MANUFACTURING CO. LTD.

SAVOY HOUSE, 115-116 STRAND, LONDON, W.C.2.

Temple Bar 9025

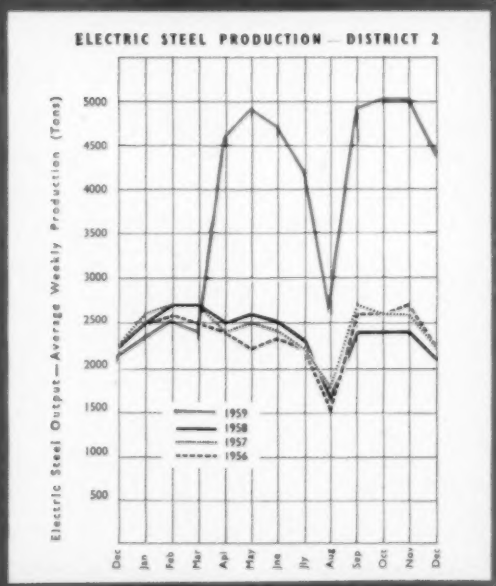
Official statistics show increase in output of tonnage electric steel

At Brymbo Steel Works Limited hot metal from a pre-refining vessel is transferred to the arc furnace where it is added to a partly molten charge of steel scrap.

No. 2. Brymbo Steel Works Limited

By the adoption of an oxygen pre-refining method, electric arc furnaces are used to produce special carbon and low alloy steel from hot blast furnace metal at Brymbo Steel Works Limited, Wrexham. Replacing a battery of four open-hearths, three 16 ft. Birlec arc furnaces, each rated at 12,500 kVA, have been commissioned since April 1959. The required output is obtained by operating two furnaces, with one standing ready, in conjunction with previously installed electric melting plant. The striking effect of the new furnaces on electric steel production for the district can be seen from the adjacent graph. The figures, which are taken from official statistics published jointly by the Iron & Steel Board and the British Iron & Steel Federation between 1956 and 1959, relate to output for Denbighshire, Flintshire, Cheshire and parts of Lancashire and Yorkshire.

Whereas electric furnaces had previously been used in this country for steel production from cold scrap, the Brymbo installation is the first to employ hot blast furnace metal.



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FOUNDRY TRADE JOURNAL

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V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.

Editor:
A. R. PARKES, M.I.B.F.

Commercial Editor:
R. M. HOWSE

Production Manager:
R. J. LOVELL

Publisher: H. J. DWYER

Circulation Manager: E. T. GRIFFITHS

District Representatives:

G. P. ELLIOTT (Northern Area) 'phone: Altrincham 1334

T. H. SMITH (Scotland) 'phone: Dumbarton 1046

D. C. RYALL (Southern Area) 'phone: TRAfalgar 6171

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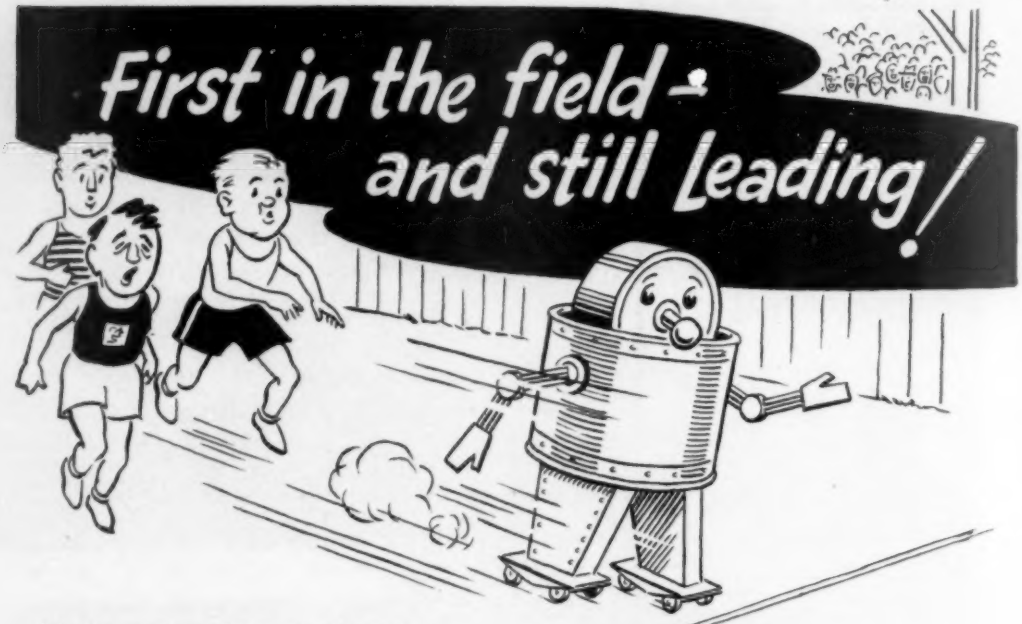
First in the field - and still leading!



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FOUNDRY
TRADE JOURNAL

Vol. 111 July 6, 1961 No. 2326

Vienna Congress Papers

Of the 1,500 foundrymen attending the recent International Foundry Congress in Vienna, quite a few must have regretted that of the 30 technical papers* presented, not one was on the subject of copper-base alloys and only three dealt with aluminium. However, there are always in international conferences a number of papers which are of equal interest to all sections. The paper by Dr. J. M. Navarro and Dr. J. Navarro-Alcacer on the flowability of moulding sands and a second by Mr. G. Blanc and Mr. J. C. Margerie on the applications of statistical methods to foundry studies are typical cases. The preprinted volume of contributions carries the full text of all the papers in either English, French or German with summaries in all three languages. Actually, 18 appear in German, seven in English and five in French. The quality of the translation of the summaries is variable, some being excellent and others needing sub-editing to be really acceptable.

Eight papers were devoted to steel castings and covered a diverse range of subjects. Dr. A. H. Sully and Mr. J. D. Lavender dealt with the detection of cracks using ultrasonic methods; Dr. R. Rinesch, Mr. H. Neudecker and Mr. J. Eibl showed how the LD process (which has enjoyed great success with large steelworks) could be applied to the making of castings; from Italy came a paper by Mr. P. Tavolotti and Mr. G. Iaccarino on the making of 100-ton steel castings using directionally-controlled solidification, and another Austrian paper by Dr. Ing. J. Czikel dealt with the possibilities of the elimination of phosphorus embrittlement. Other papers dealt with steel with special magnetic properties, hot-tearing of cast steel and super desulphurization of basic electric steel, the latter being the only contribution emanating from America.

The papers covering iron castings were as varied as they were interesting, their range embracing cupola practice, piston rings, ingot moulds and recent developments in spheroidal-graphite cast iron. Professor J. Guillamon and Mr. F. Lutz dealt with a new type of cupola engaged upon the making of both types of malleable. The main body of this cupola is of the French design with the wind-belt halfway up the stack with pipes leading down to the tuyeres, usually of the twin type. From the receiver, there is a take-off for recirculation of gases, claimed to effect many economies. The second contribution on this subject was presented by Dr. W. Patterson, Dr. H. Siepmann and Dip. Ing. H. Pacyna and is a well-documented study on cupola operation carried out with the objective of disclosing methods for obtaining optimum results. An interesting paper by Professor B. V. Rabinovich and colleagues from Moscow discloses a method of making thin-walled moulds by a method similar to core-blowing. The initial cost of the plant would seem to be high, but the reduction in the amount of material used and its transport would seem to show some advantages, potentially worthwhile. This paper is printed in English. A really novel contribution to the metallurgy of cast metals was given by Dr. R. Mitsche and his colleagues at Leoben. It was illustrated by films which showed microstructural changes of heated metals before and during liquation. One outstanding section showed just how spheroidal-graphite cast iron behaves. Summing up, the standard and interest of the papers presented at the Congress was uncommonly high.

* Synopses and abstracts of the papers presented in Vienna together with notes on some of the discussions will be printed in an early issue of the JOURNAL.

IBF Golf Meeting

Arrangements for this year's IBF Golfing Society's meeting and competitions, to be held on September 23 and 24, will follow the usual pattern, Wood Spa again being the venue, and the customary party arrangements being made at the Golf Hotel. As in previous years, presentation of the prizes at the Society's annual general meeting on the Saturday evening will be followed by an informal dinner/dance. Non-playing members as well as members will be very welcome to this event, and those wishing to participate should write as soon as possible to the secretary of the Society, Mr. J. Graham Phillips, Harper Phillips & Company, Limited, Albion Foundry, Eastgate, Grimsby, Lincs., for entry forms. Accommodation bookings should be made direct to the hotel, where special terms are offered for the period Friday evening to Sunday lunch-time inclusive. Entrance forms should be returned not later than the first week in September, and to help the organizers, subscriptions, green fees and sweepstakes, should be sent in with the entrance forms. It has been decided this year to raise the subscription from 5s. to 7s. 6d.

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On the Saturday morning there will be stroke competitions for the IBF Handicap Challenge Cup; the Scratch Challenge Cup; Veteran's Cup and the Coronation Shield, and in the afternoon a two-ball foursome competition against bogey will be held; the Stableford fourballs (three-quarter handicap) will be held on the Sunday morning. The ladies will compete on the Saturday morning for the Coronation Rose Bowl, and it may be possible to arrange a ladies competition on the Sunday morning also.

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The Soviet Exhibition, which promises to be a very interesting event, is to be held at Earls Court, London, July 7 to 29 from 10 a.m. to 10 p.m. (Sundays excepted). Included in the exhibits is a display of foundry equipment, and amongst the plant noted in a Press release are semi-automatic core-shooters; sand-slingers, a working model of a hot-blast cupola and "ladles for carrying magnesium." This latter item, it is thought, might be for use in connection with the making of nodular-graphite cast iron.

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British Standards Institution

Two standards of interest to founders making space-heating appliances have now been published. They are:—"Domestic-heating stoves using coke and other solid fuels," B.S. 3378; 1961 (price 5s.), and "Open fires with convection with or without boiler," B.S. 3376: 1961 (price 4s. 6d.). Copies are obtainable from the sales branch of the British Standards Institution, 2, Park Street, London, S.W.1.

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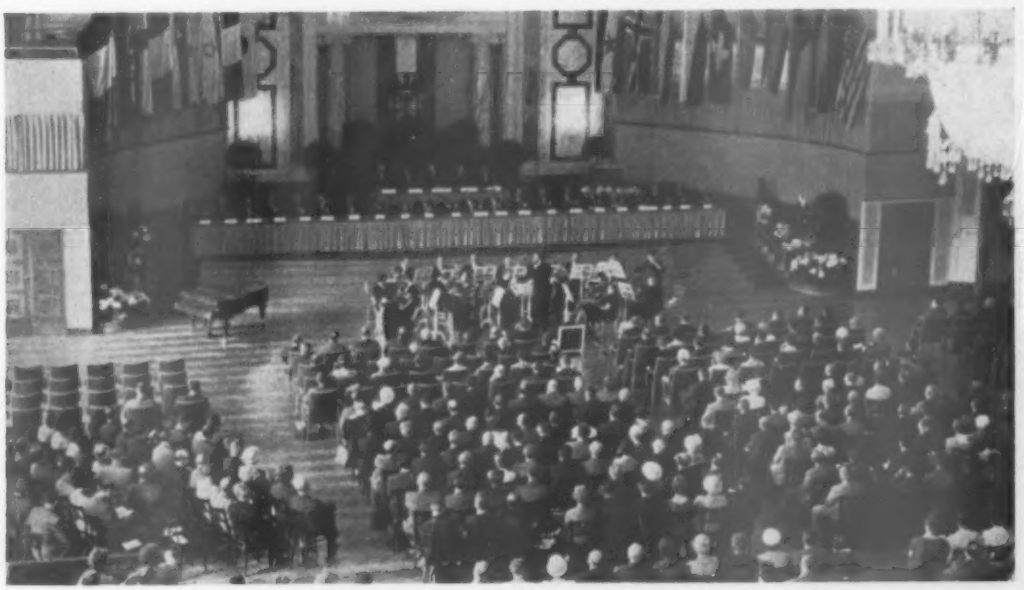

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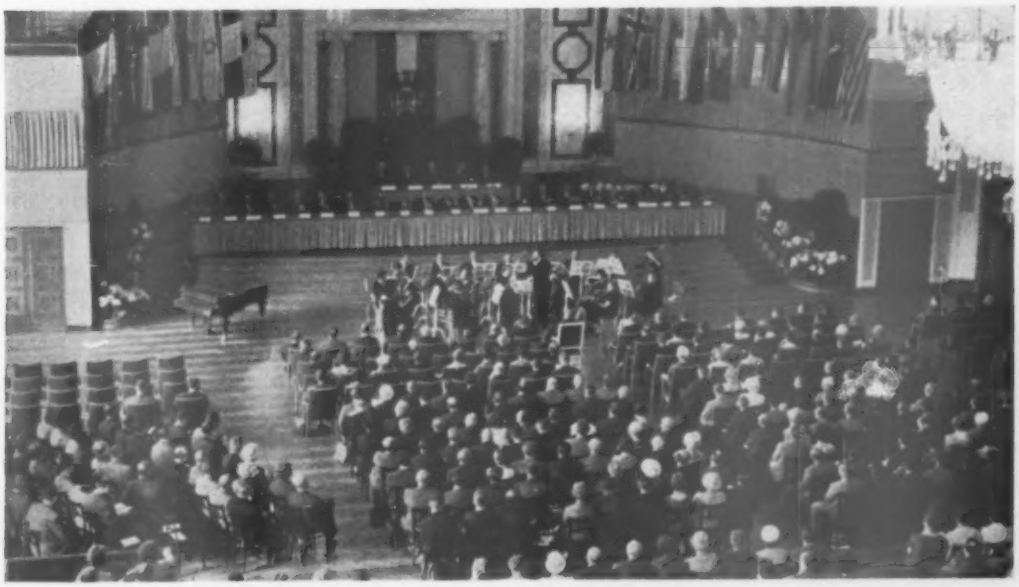


Austrian Minister for Commerce and Reconstruction, Dr. Fritz Bock, welcoming delegates to the Congress at the Monday morning ceremony.

translation services, banqueting accommodation, cafés, bars, etc., in addition to a large hall occupied by Congress offices, a travel bureau, book displays, post office, writing rooms and so on. As mentioned in the introductory paragraph earlier, the availability of this so excellent accommodation for staging a congress was a large factor in its success and the writer cannot help contrasting it with the lack of similar facilities in the United Kingdom. Unless circumstances change, when the time arrives to house another international congress of commensurate size in this country the problem of how adequately to accommodate such large numbers will be a major "headache" for the organizers.

Attendance

Of the 1,500 or more registrations of delegates for the Congress (a figure excluding casual attendances), an analysis of the list of participants shows the following approximate figures for male attendance from the 22 constituent member-countries of the International Committee of Foundry Technical Associations—under whose auspices the Congress was organized:

Belgium	15	Luxembourg ...	1
Czechoslovakia ...	21	Netherlands ...	20
Denmark	4	Norway	6
Germany	276	Austria	114
Finland	9	Poland	42
France	64	Portugal	3
Great Britain ...	46	Sweden	15
India	2	Switzerland ...	47
Italy	38	Spain	11
Japan	17	Hungary	8
Yugoslavia ...	17	USA	8

In addition to the published lists, there were a number of delegates from Russia and of course a few from various other countries. The party from the UK included the president of the Institute of British Foundrymen, Mr. D. A. Richards, and the secretary, Mr. G. Lambert, also several past-presidents of the Institute, the official delegates being Mr. Richards and Mr. M. M. Hallett, with Dr. H. T. Angus (British Cast Iron Research Association) heading the International Committee on Testing Cast Iron.

Although held under the auspices of the International Committee of Foundry Technical Associations (secretary, Dr. P. W. Muller of Switzerland), the main detail work of organizing the Congress was in the hands of the *Verein Osterreichischer Giessereifachleute* (Austrian Foundrymen's Technical Association). It was indeed a great compliment to the Congress that the president of the Austrian Republic, Dr. Adolf Scharf, had consented to be honorary patron, and there was also other Austrian ministerial and industrial collaboration at high level. Detailed arrangements were formulated by an Austrian Congress Committee comprising, Dip. Ing. J. Krammel, as president; Dr. F. Sigut, as secretary; assisted by H. Bardas-Bardenau, Ing. F. Decker, Dip. Ing. R. Ziegler, Dr. R. Schlusselberger, H. Hertlein, Ing. F. Jirsa, Ing. L. Frycfritsch and Mrs. M. Krammel. To all these people, as well as the 50-odd firms and other organizations arranging works visits, the delegates attending the Congress owe a great debt of gratitude for painstaking work well carried through.

Programme Summary

Briefly to survey the programme, the Congress began with registration and handing over of documents on the Sunday, (June 18) with also on that day a meeting of the past-presidents of the main International Committee. On the Monday, was staged the official Congress opening in the morning, technical meetings in the afternoon, followed by a sightseeing tour and a Viennese "Heuriger" session in the evening, the latter two events for both ladies and gentlemen. Simultaneously in the afternoon were held sessions of the International Committee on Testing Cast Iron and the International Working Group on Foundry Coke. Tuesday for the male delegates was one of continuous technical sessions from 8.30 a.m. to 6.15 p.m. with (simultaneously) sessions of the International Working Groups on Malleable and on Founding Properties. That day, the ladies attended a fashion school in the afternoon and in the evening a large number of Congress delegates visited a performance at Vienna State Opera House.

Technical sessions were again resumed by the majority of delegates on the Wednesday morning, that afternoon being devoted to a series of works visits, the ladies being offered visits to museums in the morning and to a porcelain works and a choir recital in the afternoon and early evening. Later that evening, the official Congress delegates (two from each constituent country of the International Committee) and their ladies, were invited to a special banquet by the Congress organizers.

Works visits occupied the whole of Thursday for male delegates, while their ladies were off on a coach excursion all day to Bergenland, to the east of Austria. That evening, too, there was a special reception for the various countries' representative delegates, as guests of the Mayor of Vienna and the municipality. Friday was free for most of the delegates except that a large number used the opportunity to see a display by the Spanish Riding School in the morning and the ladies were also offered a repeat of the visit to the porcelain factory and choir-boy performance in the afternoon. This period was utilised also for a general meeting (from 9 a.m. to well into the afternoon) of the main delegates to the International Committee of Foundry Technical Associations.

On the Friday night was staged the main social event of the week, namely the Congress banquet, and on Saturday morning a brief ceremony was held to close the Congress and report the chief findings of the various committees.

Registration

Naturally, the great majority of Congress delegates and their ladies arriving in Vienna had previously registered by post, but most of them reported at the Hofburg on the Sunday morning preceding the Congress proper to pick up documents, etc. Here, there was a full staff of the Congress organizers present to issue tickets for individual functions, to smooth out any linguistic difficulties, effect currency exchange, arrange introductions and so on. In particular, each delegate received a large number of documents and other helpful information, etc. Amongst these were a lapel-type Congress badge, attractively coloured and bearing the insignia shown at the head of this article; in addition there was handed over a separate name badge in bold lettering, carrying also flashes indicating the languages spoken by the wearer.

It had been hoped to issue a preprinted volume of the Congress papers at least a month in advance of the event, but this had proved impossible (probably due to lateness in receipt of papers from authors or to difficulties in translation or printing). Instead, each member was handed the 365-page volume of Papers* on the Sunday, along with other documents, which included a list of participants, a separate programme summary, containing some additions (including mention of two Papers not previously listed in the main programme†) and a four-language review/brochure describing Austrian industry, products, fashions, textiles, etc.

Also supplied were a special issue (June) of the

* Additional copies of the volume of Congress Papers are available from the Congress secretary, Dr. F. Sigut, *Verein Osterreichischer Giessereifachleute*, Ferstelgasse 1, Vienna, 9, at a cost of 250 Austrian sch. (about £3 12s.) plus postage. Individual Papers are also available at 12 Austrian sch. each (about 3s. 6d.), again plus postage.

† The main programme of Papers was printed in the April 27 issue of the JOURNAL; the two new Papers listed were "Inherent Tendency to Hot-tearing of Cast Steel," by A. de Sy, J. van Eeghem, and R. de Groote (Belgium) and "Cast Steel with Special Magnetic Properties," by H. Luling and K. Gut (Switzerland).

Main assembly of Congress delegates and their ladies in the Festsaal of the Hofburg for the opening ceremony. In the foreground is shown part of the Vienna Concert Orchestra which gave musical renderings appropriate to the occasion.

Vienna Diary

Austrian foundry journal, *Giesserei Nachrichten*, surveying in its contents the personnel of the industry and Congress officials and also reviewing sections of the country's foundry industry, quoting statistics and embracing articles on training methods, research and employers' organizations. Miscellaneous material handed to each participant included no fewer than three maps of Vienna and Austria, travel brochures, books of tickets, currency-exchange ready-reckoners, a notebook, lists of hotels in Austria, places of cultural interest in Vienna, restaurants and so on, the whole making a quite weighty parcel.

As a permanent memento of the Congress, each man was also handed a handsome cast-iron plaque about 5 in. by 4 in. bearing the IGK symbol interwoven with ancient symbols for metals, iron and steel. This was produced by Alois Rittmanns Nachf. Dipl. Ing. Hugo Lenhard & Company, engineers and founders, of Leoben.

Monday's Events

The first main event of the Congress was a brilliantly-staged opening ceremony held in the banqueting hall of the Congress Building (Hofburg). This was attended in the body of the Hall by approximately 1,000 Congress delegates and their ladies, though perhaps a smaller proportion of the latter were present than usual on such occasions. On the stage facing the audience was an august assembly of representatives of the individual countries participating, seated in line behind their respective national flags. Amongst these, it was noted that the Israeli delegate appeared to be missing and that Dr. A. B. Everest was representing the United States.

Seated on the stage behind the official delegates were (from left to right facing the audience) Mr. M. Vuilleumier (Committee past-president and now treasurer), Professor Ing. J. S. Darnis (the Committee president), Dipl. Ing. J. Krammel (the Austrian president of the Congress), Mr. R. Doat (Committee vice-president), and Dr. Muller (secretary). In between the platform and the audience was accommodated a section of the Vienna Concert Orchestra, under the direction of Paul Angerer.

The Hall itself was most impressive. Its walls are lined in contrasting types of marble and surmounted by painted murals, the ceiling also carrying paintings, the whole representing phases of Austrian history and biblical scenes. A backcloth to the stage was provided by the Austrian flag and emblem and the side decoration consisted of drapings comprised of large national flags of the 22 countries of the Committee.

The proceedings began (at 10 a.m.) with the Austrian national anthem, followed by a rendering of Schubert's Symphony No. 5 by the orchestra.

In the opening address, Mr. J. Krammel (chairman of the Austrian Foundrymen's Association and this year's president of the Congress) welcomed delegates and their ladies, first in German, then in French and finally in English, saying that 1,200 delegates and ladies were expected from the 22 foreign countries represented. Mr. Krammel spoke distinctly, his pronunciation being equally good in all three languages. He pointed out that the Congress was being held in Vienna's largest conference building, formerly the historical Imperial Palace (the Hofburg) which served—up to the end of the first world war—as the representative residence of the Hapsburg dynasty. For centuries, he said, the Hapsburgs had influenced Europe's fate decisively, both politically and culturally, and the historic city of Vienna extended a welcome to all guests from abroad. The task of the Congress, however, Mr. Krammell continued, was not of historical, but of a practical and scientific nature. We did not live in the past history but in the competitive present, and he was glad to be able to state that Vienna and Austria had kept in line with the technical and scientific developments in the foundry sphere. The lectures, meeting of the various committees and works visits of the coming days would bear testimony to the serious professional work of the Congress and in this sense, he offered all present greetings from scientific Vienna.

International President's Address

The next speaker was Prof. I. Sans Darnis (vice-president of the Spanish Iron and Steel Research Institute and president of the International Committee of Foundry Technical Associations). His long speech, in French, was rather difficult for most of the assembly to follow because of his hard Spanish accent. He first pointed out that he regarded it as his special honour to be able to welcome the Federal President of the Austrian Republic, Dr. Adolf Scharf, and to thank him for his willingness to perform the opening ceremony of the 28th International Foundry Congress. On behalf of the International Committee, Professor Darnis also thanked Mr. Krammel for his words of welcome and extended his best wishes to the authors of the papers to be presented, to the chairmen and members of committees and to the international working groups, to the delegates of the European Committee of Foundry Technical Associations and finally to all the delegates present at the Congress. Considering the very interesting and varied programme and the pleasant atmosphere of the meeting, Professor Darnis said he had no doubt that the Vienna Congress would be a great success and would rank prominently among the congresses already held. This, he said, was the wish of all present and he was happy to take the opportunity of expressing everyone's appreciation to the host country.

Past and Future

Professor Darnis then gave a historical survey of the activities of the International Committee. He recalled that the technical foundry associations of Belgium, France, Great Britain and the USA agreed in 1922 to arrange international con-

gresses to promote opportunities to make recent developments of foundry technology known on a broad basis, to discuss these developments, and to exchange experiences gained, one nation with another. The first congress was held in Paris in 1923 and was followed by a second in 1926, held in Detroit. These first two congresses were organized by the respective national associations and no system of organization on a higher level existed which could have taken the lead. The realization of the necessity and expediency of co-operation between the national associations had led, in December, 1926, to the foundation of the International Committee of Foundry Technical Associations which had its seat in Brussels and comprised Belgium, France, Great Britain and Germany. In 1928, Luxembourg, Holland and the USA joined the committee, followed by Poland in 1930. Professor Darnis then listed the present 22 member-countries of the Committee.

The present executive office of the International Committee, continued Professor Darnis, was in Zurich, with Dr. Muller as secretary, his position being supported by contributions made by member-countries. This was a fairly recent development (1959), due to the immensely enlarged work previously carried out for years in an honorary capacity by the late secretary of the Institute of British Foundrymen, Mr. T. Makemson, followed by his successor, Mr. G. Lambert. During the present Congress, he said that the past-presidents' committee (formed in 1954) and the plenary meeting of the International Committee would deal with many problems arising from the original statutes of 1930 which defined the basic aims as: (1) To promote co-operation of member associations of the Committee and to provide, above all, for the free exchange of research findings and of publications among the Committee's member associations, and (2) to fix a time-table for international congresses and for international foundry exhibitions under their auspices.

New Ideas

Past congresses, Professor Darnis said, had demonstrated that these two ideas had been realized very satisfactorily. However, as international co-operation for the solution of technical problems was the principal aim of the Committee and as the present office of the secretary, Dr. Mul'er, was overwhelmed with administrative functions, it might be necessary to fol'ow the routine of other international organizations similar to the International Committee. One such solution would be the establishment of a new secretariat for technical matters; this would mean that there would be two secretariats and two secretaries, one administrative and one technical. An a'ternative solution put forward was the estab'ishment of a general secretariat which could perform both functions simultaneously. Both these solutions, however, he continued, would require a highly-qualified expert in questions of foundry technology and well acquainted also with the situations prevai'ing in different countries. Apart from the difficulty of finding the right person for the job, both suggestions would increase expenses and this, in turn, would require a substantial increase in the annual fees paid by member associations.

A third possibility, put forward by Professor Darnis, was that the term of presidency should be extended to a period of a minimum of two to three years, which would likewise have to apply to the position of the vice-president (at present Mr. Doat of Belgium) and the treasurer (at present Mr. Vuil'eumier of Switzerland). This suggestion, he said, was based on the belief that if the president and/or the vice-president could continue in office for a longer period, he or both could give better guidance than under the conditions of annual change prevailing at present.

Next there was a short address of personal welcome on behalf of his Ministry given in the three languages of the Congress by Dr. F. Bock, the Austrian Minister for Commerce and Reconstruction.

Austrian President's Speech

The Austrian Federal President, Dr. Scharf, then addressed the audience speaking in his mother tongue. He said that concert halls and workshops in Austria stood side by side. The Austrian way of life originated in a country which from time immemorial had not on'y been a country of mountains and forests, but also of ironworks and copper smelters. About 2,000 years ago, a town of unknown name had existed on the Magda'en Mountain in the Austrian province of Carinthia, which town was an important trading centre for iron coming from the Roman province of Noricum (now Styria). After the second world war and after two occupations, Austria's heavy industry had practically been destroyed and production had fallen to a negligible amount. However, the country's production to-day was several times that of the pre-war year of 1937, and Austrian output of iron, steel and malleable-iron castings amounted to about one per cent. of the combined production of a'l Western European countries, plus the USA.

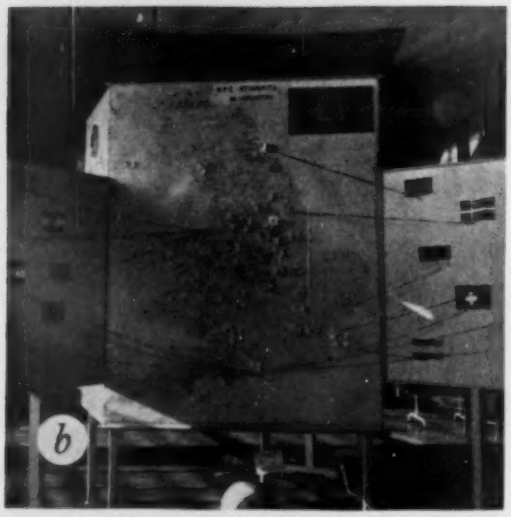
The Federal President stressed that this result could not have been achieved without American aid, but stressed that financial credits and monetary gifts alone would not have been sufficient to rebuild foundries and other workshops—perseverance, industry and devoted work had played a major part. Austrians, he said, had learned how to bear the misfortunes of fate. Outside observers might have thought on occasions that they had submitted to some of the evils inflicted upon them. In the end, however, it always became apparent that Austria had remained true to itself and that it had, in its own way, repulsed those who wished to impose a foreign way of life on its population.

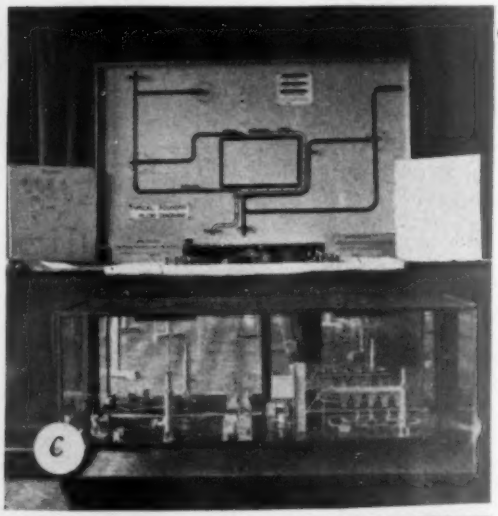
Dr. Scharf then officially declared the 28th International Foundry Congress open and the Vienna State Orchestra followed next by the playing of Haydn's 59th Symphony (the "fire" symphony) as a delightful conclusion to the opening ceremony.

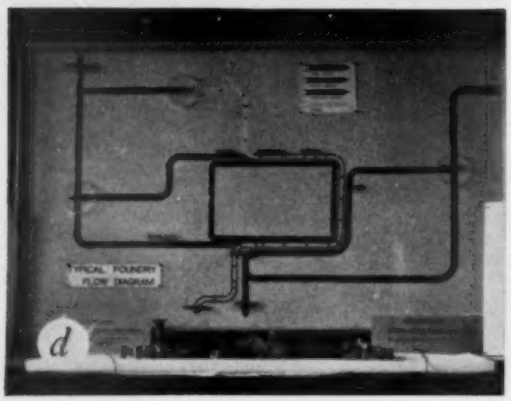
(To be continued)

NFC "Open Day"

An account of the National Foundry College "Open-day" and the activities that occurred there was given in the JOURNAL *on June 15. The accompanying photographs cover various aspects of these events. (a) General view of the presentation of the diplomas (NFC) by Sir Cyril Musgrave, president of the Iron and Steel Board, to successful students from last year. Present also on the platform were the NFC board of governors, Sir F. Scopes, J. H. Osborn,* M.P.*—an ex-NFC student—and Mr. C. H. Davies, Mayor of Wolverhampton; (b) part of the exhibition erected during Commonwealth Technical Training Week, showing distribution in industry of past students; (c) flow diagram (above) with case of exhibits (below) illustrating handling magnitudes involved using two different methods of production; (d) enlarged view of the flow diagram equipped with flashing lights to indicate materials movement; (e) experimental work being carried out in the metallurgical laboratory.*







Measurement of Epoxy-resin Mixes

By M. Callaghan

Epoxy resins are now established as useful materials for patternmaking, and there are many good reasons why they will continue to be so used. This article is intended to assist users to make a more economic use of the process by suggesting a system of measurement and a method of reducing time lags to a minimum.

The material costs of resins is higher than any other patternmaking material and costly wastage can be reduced if the required amount of resin is known before mixing takes place. A further point of importance regarding measurement concerns accurate weighing and dispensing of resins, filler, hardener and accelerator. This is essential if a first-class pattern is to result. Estimating of quantities required may be carried out by the three-stage system outlined in what follows, the stages being (*a*) estimating weight of gross quantity; (*b*) estimating quantity of each constituent, *i.e.*, resin, filler, hardener, and (*c*) estimating amount of accelerator. Each of these three stages of measurement are independent of each other and thus can be used singly when the others are not considered necessary.

Estimating Weight of Gross Quantities

Dealing first with stage one, estimating the weight of gross quantities, the basis for finding the weight in the usual method is volume by density. The example taken in this article uses 180 parts slate filler, 100 parts resin and 50 parts hardener which, when tested, produced a density figure of 0.066 lb. per cu. in. While the density of this mixture will be constant, the volume will vary each time a different pattern has to be made. The variable factor, *i.e.*, volume, is found as follows:—Fig. 1 shows a measuring box, the total volume of which is known to be 250 cu. in. The inside of the box is divided into 40 heights, each one $\frac{1}{4}$ in. higher than the level below it.

Fig. 2 shows a section through a mould which has been sealed by applying two coats of shellac. The filling core and flood strips are also in position. Into this mould is poured a dry, loose silica sand until the mould is filled to the top of the flood strips. The filling core can now be removed and the sand poured from the mould into the measuring box (Fig. 1). The sand thus poured into the measuring box is made level and the height of this level is noted. The volume of resin required is not known and as the density of each different mix can be found by weighing a specimen of a previous mix, then the weight of the resin can be found. To do this, a graph similar to the one shown in Fig. 3 is made. The vertical lines are spaced equally and represent levels in the box, *i.e.*, 0 to 40. The horizontal lines on the graph represent weight in lb. and are also subdivided into 4-oz. divisions. To set the gradient line, calculate weight of mixture for maximum volume of measuring box thus:—Total height by area of box by density of mixture, *i.e.*, 5 by 50 by 0.066 = 16.5 lb. Mark this weight off on the right-hand vertical line and next join this point 0 on the left-hand bottom corner of the graph. The graph is now completed and the weight can now be read off for any level of the measuring box and if the box has to be filled several times, this can easily be dealt with also.

Example:

If the measuring box has to be filled twice and then to level 10, *i.e.*, 40 + 40 + 10 = 90 divisions, read off level 30 in Fig. 3 and multiply reading by 3, *i.e.*, level 30 corresponds to 12 lb. 6 oz. thus weight of resin required is 12 lb. 6 oz. by 3, *i.e.*, 37 lb. 2 oz.

It is possible to use the graph shown in Fig. 3 for more than one mix by determining the density of each different mixture having a different ratio of constituents or type of filler, then multiplying the new density figure by 250 and entering the gradient on the graph. If the gradient lines are drawn in different colours, each line is more easily distinguishable.

If gel coats and laminating coats have to be applied, their weight can be taken and subtracted from the weight of the gross mix. A guide to the weight of gel coats is that 2 oz. of gel coat will cover an area of 1 sq. ft.

Estimating Quantity of each Constituent

Recalling that the ratios in this article are 180 parts slate filler, 100 parts resin and 50 parts hardener, the second system—estimating the quantity of each constituent—is dealt with. From the graph shown in Fig. 4, the vertical lines represent the gross weight of a mix 0 to 20 lb., with subdivisions of 4 oz. each. The horizontal lines represent the weight of constituents in lb., also sub-divided into 4-oz. sections. Calculate maximum quantities for a 20-lb. mix, adding 4 per cent. allowance for transfer loss. Therefore 20 lb. becomes 20.8 lb. and sum of parts = 180 + 100 + 50 = 330 parts.

Maximum weight of filler = $\frac{180}{330} \times 20.8 = 11$ lb. $5\frac{1}{2}$ oz.

Maximum weight of resin = $\frac{100}{330} \times 20.8 = 6$ lb. 5 oz.

Maximum weight of hardener = $\frac{50}{330} \times 20.8 = 3$ lb. $2\frac{1}{2}$ oz.

Next, these weights are marked off on the

Measurement of Epoxy-resin Mixes

right-hand vertical line as shown in Fig. 4, all three points to 0 in the bottom left-hand corner of the graph. Each gradient may be indicated by the initial letter of the material (as indicated in Fig. 4).

The transfer loss of 4 per cent. is an arbitrary figure and may be maintained at a low level by using good mixing containers, *i.e.*, plastic buckets for larger mixes, and tin cans (without inside rims) for smaller sizes. The residue of the cans may also be scraped into the mould. As can be seen from Fig. 4, any weight in lb. and oz. of resin, filler and hardener can be read off for a gross weight of 20 lb. accurately and quickly.

Accelerator

The accelerator is a critical addition, and on its use depends the rate of acceleration of the mix. A slow-operating exothermic action is set up when resin and hardener come together and this heat evolution is much increased by the addition of an accelerator. The following points should be noted when using an accelerator:—(1) If the mould forms a bulky mixture, then the heat generated between resin and hardener is concentrated, and one per cent. by weight of resin would be sufficient. If however the same weight of mixture occupied a mould of thin section but had a large surface area exposed to the atmosphere, then the heat generated by the reaction can more readily escape and a larger proportion of accelerator, *i.e.*, five per cent. by weight of resin, should be added. (2) If the mould be of metal, then the greater conductivity of this material will take off heat generated internally, and hence an increase in accelerator is required—three per cent. in a metal mould is the equivalent of two per cent. in a stucco or sand mould. (3) The time taken for a mix to solidify can be reduced by the amount of accelerator being increased. (4) The temperature of curing atmosphere has an effect on the rate of solidification. Hence, a large volume to surface area ratio; use of a stucco mould; high curing temperature (up to 120 deg. F.), and longer time of curing will reduce the amount of accelerator necessary. It is therefore not possible to produce a constant accelerator ratio and the above-mentioned factors based on experience is the only guide. It is best to "err on the low side" when in doubt as curing will certainly take place and the working life of the mix is prolonged by less accelerator, whilst if the accelerator is too high, air locks, shrinkage voids and, in some cases, even cracking on solidification can result.

Air enters the mixture during the stirring of filler, resin and hardener and the mix should be stirred gently and in such a way that air is not added as with egg beating. If the accelerator acts too quickly when the mix is poured into the into the mould, the air in the mix can be trapped causing pinholes and when this occurs on the surface of gel coats, the defect to the working face of the pattern can be serious. Pinholes can be eliminated largely by premixing resin and filler some hours before use, then the hardener can be added one hour before use, the waiting time allowing the air to escape.

Pre-mixed gels can be obtained from manufacturers and the general advantage of these is that there is a more thorough mixing of the filler and resin, as mixing is carried out by machine and entrapped air is very unlikely.

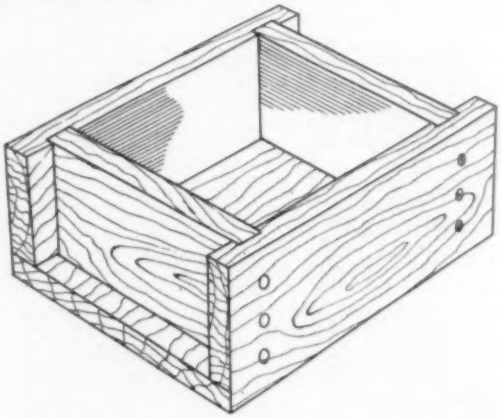


FIG. 1.—*Graduated measuring box of known quantity used in conjunction with density table for calculating total weight. The depth is divided into 40 equal numbered parts. In this example the box dimensions are 7.07-in. square by 5-in. deep giving 250 cu. in. capacity.*

Types of Gel Coats

Two types of gel coats might be mentioned. Carborundum filler gives an excellent hard-wearing surface, but it is very difficult to mix in by hand and if a machine for mixing is not available, it is better to obtain this type of gel coat from a

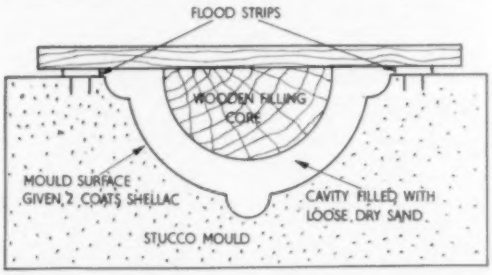


FIG. 2.—*Section through mould used to assess total volume of the various constituents needed.*

manufacturer. Coloured gel coats are available and in standard colours, the advantage of these being that as the pattern does not require to be painted afterwards, there is a saving in materials and time, whilst the surface finish is superior to

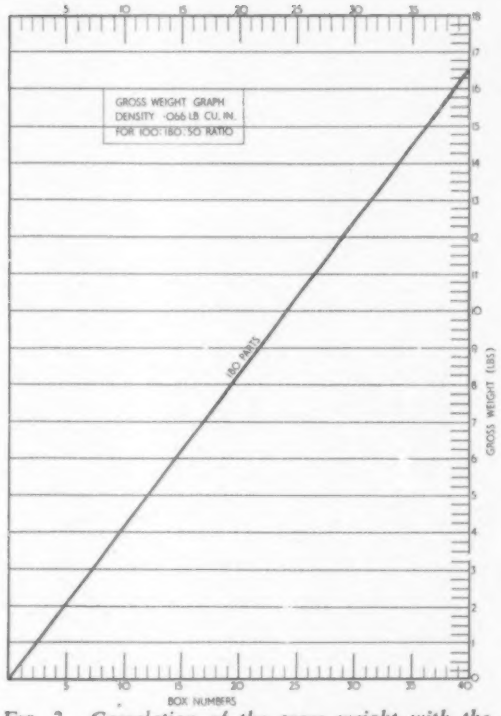


FIG. 3.—*Correlation of the gross weight with the volume occupied by the pattern.*

the painted one. The coreprint portion of the pattern could be painted in the usual manner if required, but gel coats are also available for this purpose. Colour gel coats are easier to apply than standard gel coats and the gelling action takes place in about half the time required for the other materials. There is, however, a disadvantage in the use of colour gel coats in that they can be applied only to dry moulds, as discoloration or streaking on the pattern surface is possible if the gel coats are applied to damp moulds. As all pre-mixed gel coats are free from entrapped air, a higher amount of accelerator can be used without the danger of surface pinholes on the pattern, although colour-stable gel coats do not require any additions of accelerator.

FIG. 4.—*Weight of each constituent may be read off directly from this graph of a standard mix.*

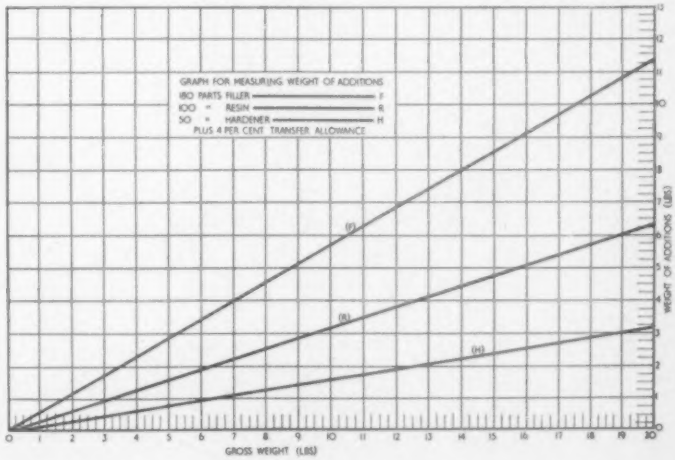
Estimating Amount of Accelerator

Fig. 5 shows a method of estimating the amount of accelerator. The vertical lines on the graph show number of parts accelerator over the maximum range, *i.e.*, 0 to 10 parts, sub-divided into ¼ sections; the horizontal lines indicate the number of cu. cm. of accelerator per lb. of resin. It is better to estimate quantities of accelerator in a measuring cylinder calibrated in cu. cm., as the weight of accelerator is often too small to register on scales unless they are of the most-sensitive type. To convert weight to capacity, take 1 fluid oz. as 28.1 cu. cm. Therefore 10 parts accelerator = 1.6 oz. per lb. of resin = 1.6 × 28.1 = 44.96 cu. cm., taken as 45 cc. Next, set out the gradient line by joining 45 on the right-hand vertical to 0 on the left-hand side of bottom line and from this graph, the quantity of accelerator per lb. of resin can be found easily.

To sum up the measuring system, let us take one example. The mould is first filled with dry silica sand as previously described and tipped into the measuring box to read level 38. This represents 16 lb. 10 oz. in Fig. 3 or 9 lb. 8 oz. filler, 5 lb. 4 oz. resin, 2 lb. 10 oz. hardener in Fig. 4 (transfer loss of four per cent. included). Say three parts accelerator were required, this represents 13.5 cc. per lb. in the graph shown in Fig. 5 or for 5¼ lb. of resin, accelerator required $= (13.5 \times 5) + \frac{13.5}{4}$, which is approximately 71 cc. Experience will probably show that 3 cc. of accelerator drains back into the measuring tube, so it should in this case be filled to 74 cc.

Overcoming Time-lag

There is as yet no way of completely overcoming time-lags between operations, but these can be reduced to a minimum by remembering that damp stucco moulds are now quite safe. The proportioning of accelerator can, by the measuring system described, now be more accurately and



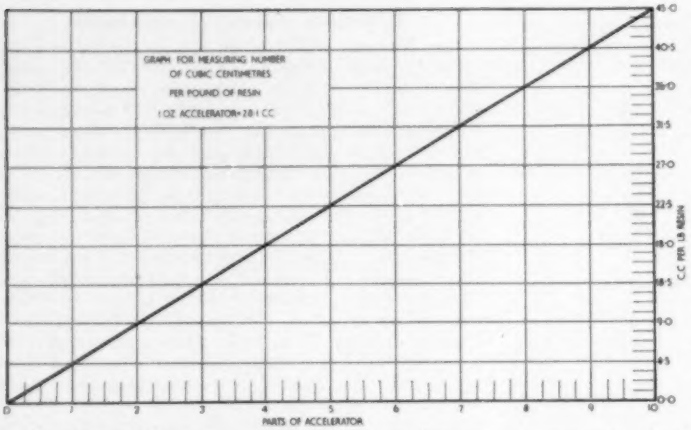

GRAPH FOR MEASURING NUMBER
OF CUBIC CENTIMETRES
PER POUND OF RESIN
1 OZ ACCELERATOR = 28·1 CC
CC PER LB RESIN
PARTS OF ACCELERATOR

FIG. 5.—*Third stage of preparation is the critical one of adding the accelerator. The appropriate number of parts is here related to their volume in cc.*

easily determined to ¼ of a part and so by experience the optimum amount of accelerator may be used. Finally, time lags can be partially overcome by careful planning of the whole process of operations.

Planning Process of Operations

As stated, time lags can be reduced by planning the process of operations and next, one method of producing the pattern from the mould shown in Fig. 2 makes the maximum use of time lags. The suggested process begins only where the time lags begin to occur. In describing the production of the pattern, the operations in parenthesis denote those which can be carried out during the various time lags:—

Pour plaster over pattern (clean out bucket, tidy up work space, wash hands); turn over mould, remove patternbox frame (cut and fit flood strips). Apply first coat of shellac sealing agent to mould face (commence making the filling core); apply second coat of shellac to mould face (complete making filling core); place filling core roughly in position and fill mould with dry, loose, silica sand. Remove filling core and pour sand from mould into measuring box and brush the mould clean of sand particles and apply the first coat of mould release. Here again there is another time lag and this can be used to level off the sand in the measuring box and take the reading, referring this reading to the graph shown in Fig. 3 for gross weight; mix gel coat (except accelerator), weigh mix and subtract from gross weight; apply second coat of mould release. While this is drying, add accelerator to gel coat and stir in gently. By this time, it will be time to apply the third coat of mould release and apply gel coat to mould face. Here once again, there will be another time lag and this can be used in the making up of the laminating mix and subtracting its weight from gross weight. Taking this revised gross weight, refer to the graph shown in Fig. 4. With these estimates from this graph, mix together resin and filler for main mix, measure out hardener (but leave in a separate container), measure out accelerator (but leave in measuring tube).

Next, cut out laminating cloth, remembering it is important to take precautions to avoid folds or "tucks" especially in the first layer of cloth, as these points will result in a weakness. The cloth should be "nicked" at positions where folds or tucks are likely to occur (see Fig. 6). Note that a one-piece laminate around the flange thickness can cause a defect due to entrapped air—see Fig. 7. As the edges of flanges in any pattern are always vulnerable to damage, they must be well protected on all standard equipment. Therefore, in plastic patterns, chipping off is possible if air bubbles are between the gel coat and laminates. Flange sections of the mould should be laminated with several pieces (as shown in (Fig. 8) if air locks are to be completely avoided. Laminating cloth should be cut roughly to the shape of irregular outlines of mould surfaces.

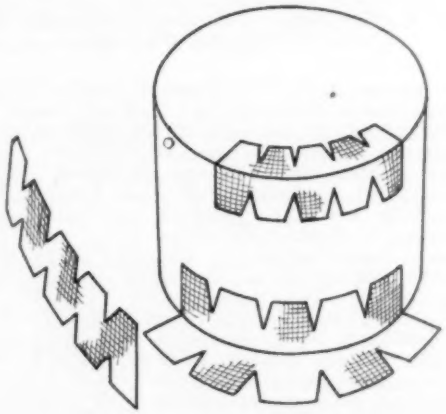
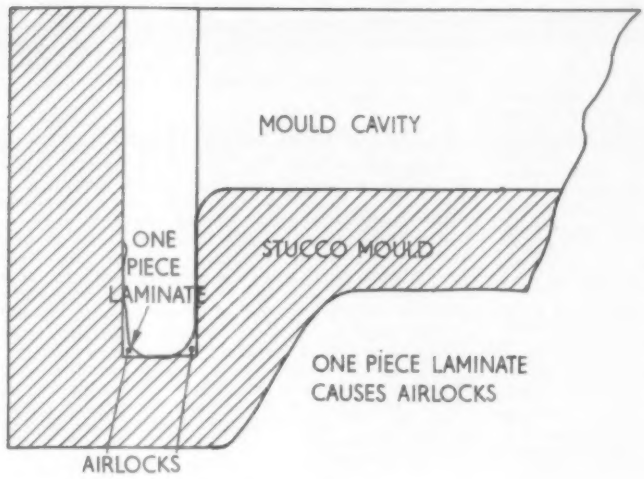
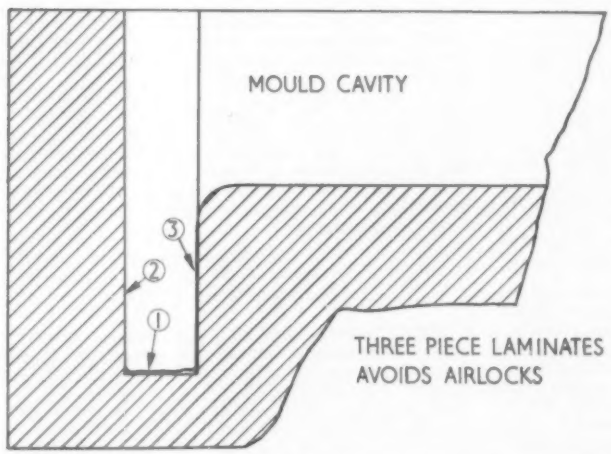


FIG. 6.—*Illustration of the method of cutting the laminated fabric to avoid folds.*

Now the hardener is added to the main mix and stirred in gently. Next apply laminating mix to gel coat and place on first layer of laminating cloth; additional layers may be added but loose strand matting will give sufficient strength to a pattern and at the same time it is cheaper than the woven type of matting. Loose-strand matting





FIGS. 7 (*top*) *and* 8.—*Sketches illustrate the advantage of using several separate pieces of fabric —rather than one continuous strip—to avoid entrapped air when turning enclosed corners.*

has a loose side and a firm side and it is as well to detect this before applying it and this can be done by stretching a piece of matting between the thumb and index fingers of each hand and feeling the loose end by gently moving the thumbs and fingers on each other. It is important that the loose side be placed downwards because otherwise the loose strands will attach themselves to the brush for applying the preceding mix, causing an unmanageable mess and reduction of efficiency of the mat. The final operations consist of adding the accelerator to the main mix and gently stirring it in, placing the filling core in position and then pouring the main mix into the mould.

Conclusions

The criticism to the production procedure described in the article may be that too many plastic mixes are lying about and confusion could result. However, mistakes are not likely with experienced operators as the various mixes are easily identifiable by their different colours and viscosity. The production cycle described applies to wet plaster and wooden patterns only; if dry plaster moulds are needed, a cycle of operations would have to be planned, working on several patterns.

Successful Year repeated

In his first statement as chairman at the annual meeting of Worthington-Simpson, Limited, manufacturers of pumping machinery, brass and iron castings, etc., of Newark (Notts), Mr. P. B. H. Brown reported a net profit of £519,023 (£476,051) for the year ended December 31, 1960. The company, he said, sold a record number of units of standard ranges of equipment and output of these was 20 per cent. up on 1959.

By economies resulting from greater output and improved manufacturing methods, price increases have, generally, been avoided, but it is feared that profit margins must shrink. The present order-book, however, is in a very satisfactory state and the board felt justified in recommending a final dividend of 15 per cent. to make 25 per cent. for the year.

Cleaner Air

Steps are to be taken by the Park Gate Iron & Steel Company, Limited, to reduce nuisance from smoke, dust, and chemical emission from its works at Rotherham (Yorks), include the replacing of steam by diesel-electric locomotives—by the end of July, 12 steam locomotives will have been replaced. Oil-firing installations for the boilers are now complete and two reheating furnaces will be converted from coal-firing to oil-firing by January, 1962.

Inferior quarry gradings of ore have now been discarded. This is one of the difficulties arising from blast furnace operation, says the statement. A third quarry also with better ore will soon replace an inferior site. Improvements have also been made to other various fittings in the plant and one blast furnace is scheduled to be rebuilt and relined.

Notes from the Branches

South Africa

"Second Opinions on Some Casting Defects" was the title chosen by Mr. F. C. Goldsmith for his paper to the February meeting of the South African branch of the Institute of British Foundrymen.

One examination detailed by the speaker, concerned a cast-iron roller housing on which smooth-sided cavities had been brought to light on machining, some of which contained small globules of metal. The casting was one of four cast in the same box through a small runner on the under side of a threaded boss. The metal when analyzed was found to be of the following percentage composition:—T.C. 3.25; Si 1.84; P 1.09; Mn 0.33, and S 0.092.

The cavities, said Mr. Goldsmith, were almost certainly due to the trapping of mould gases in the metal during pouring and it appeared that the metal was sluggish. This might have been caused by the fact that the sulphur was by no means balanced by the manganese and it was recommended that the manganese be increased to at least 0.6 per cent. However, further investigation showed that the sluggish metal was most probably due to oxidizing conditions in the furnace.

The author advised local foundrymen to bear in mind the fact that textbooks and overseas advisors assess coke charges based on a coke having an ash content of from eight per cent. to 10 per cent. In South Africa, however, one must work with an ash content of 20 per cent. Thus for every 100 lb. of coke recommended overseas, in South Africa 112 to 114 lb. must be used to obtain the same amount of combustible carbon. This, he said, led to the necessity of adding increased fluxing media, and whilst a standard recommendation of a weight based on three per cent. of the iron charge, or roughly one quarter by weight of the coke charge, might introduce sufficient limestone overseas, in South Africa the ratio could well go up to nearly four per cent. or one third of the coke split.

In the case of the roller housing the metal might have had all appearances of being hot when tapped from the furnace, but an insufficiency of coke in each split could lead to a progressive dropping of the bed height in the cupola which would induce oxidizing conditions in the furnace. Metal melted under these conditions tends to possess a shorter liquid life and by the time the moulds are filled any dissolved gases, and gases carried in during pouring, are entrapped below the rapidly freezing skin of the casting.

Reject Gunmetal Casting

A rejected casting was therefore examined to identify the cause of blemishes found under the skin after machining. Investigation showed that the inclusions complained of were in fact aluminium oxide, and that the alloy, which should have been a straight 85/5/5/5 gunmetal, did in fact contain 0.1 per cent. of aluminium. Although not an extremely high percentage of aluminium the method of running the job, which followed standard gunmetal practice, led to the formation of oxide which was carried straight into the mould cavity and came to rest on the upper face of the casting. Remedies for this type of defect would be to either flux the metal with a chemical mixture capable of removing the aluminium from the alloy, or to run the casting in a method similar to that used for manganese or aluminium-bronze castings. Mr. Goldsmith pointed out that inclusions in gunmetals need not be entirely due to impurities in the alloy. Turbulent casting could cause oxidation of some of the alloying ingredients themselves which may then become entrapped in the casting. He stressed that care should therefore be taken to ensure that the metal proceeded through the running system at a uniform rate.

Clean Ladles Essential

Bad ladle or crucible practice was another source of rejects in ferrous and non-ferrous foundries, said the author. Slag and oxides left over from previous casts, unless thoroughly cleaned from the walls and lips of the pouring vessels could be taken up in the next lot of metal and carried into the moulds. Teapot spouts were not a true answer to the problem of dirt and unless they were tipped over backwards to remove the final dirt and scum this would become embedded in the channel. The author also gave opinions on defective phosphor-bronze and aluminium castings.

The president, Mr. D. Gordon Jones who was in the chair, called on Mr. B. G. Pidermann to open the discussion and at the conclusion of a lively question time, Mr. J. Peers proposed a hearty vote of thanks to Mr. Goldsmith.

Australia (Victoria)

The May meeting of the Australia (Victoria) branch, at the Union House Dining Room (Ground floor), University of Melbourne, took the form of a round table conference with Mr. W. Silvester of Repco Pty., Limited, in the chair. Dinner at 7 p.m. was followed by a discussion on "Air Pollution Control" the speakers being Mr. W. Shaw, Department of Health, whose subject was "Air Pollution and the Health Problem"; Mr. K. Ellis, Davis & Baird Pty., Limited, who dealt with "Foundry Emissions," and "Dust-collection Methods" were the concern of Mr. F. Eager, McPherson's, Limited.

Hobson Golf Trophy

Willie Hobson, Falkirk, had been organizer of Allied Ironfounders' annual golf outing for 39 years. He was a keen sportsman and always played in the competition himself. But he never won a prize! In May last year Willie retired after nearly 50 years' service with the Falkirk Iron Company, Limited. Early this year he died and his body was cremated. Instead of sending flowers, the 68 competitors in the annual golf competition clubbed together and purchased a handsome silver cup. They named it the Willie Hobson Trophy. And in memory of Willie's many unsuccessful attempts to win a prize, it was decided to offer the cup as the award for the best performance by anyone who had never won a prize before in an Allied Ironfounders golf competition. The trophy was offered for the first time at Allied's recent golf outing at the Royal Musselburgh course. Ironically, it was won by 15-year-old Forth & Clyde office boy Colin Grant—the youngest employee ever to take part in the competition!

Latest Foundry Statistics

Ironfounding: According to the Council of Ironfoundry Associations there were 131,354 employed in the UK ironfounding industry during the week ending April 29. This is 420 fewer than the previous month but 2,002 more than a year ago.

SECTION DEVOTED TO THE TECHNOLOGY OF PRODUCING DIMENSIONALLY-ACCURATE CASTINGS

Control of Product Quality*

By Frank Nixon, B.Sc.(Hons.Eng.), M.I.Mech.E., F.R.Ae.S., M.I.Prod.E

It is a common error to assume that quality control is just another term for inspection or to assume that it is synonymous with statistical quality control. This is extremely unfortunate, because in fact the control of product quality, as it is practised to an increasing extent in the USA, in Japan, in India, and in many European countries, is a cheap and simple means of increasing productivity, of reducing wastage, and of obtaining better products at less cost. Since oversees competitors are already benefiting from its application and practice, manufacturers in the UK can no longer afford not to use this aid.

If manufacturing industry in general has been slow to understand and to adopt the conception of quality control, it is not surprising that founders, who are often concerned with intermediate rather than final products, should lag still further behind. The attitude very often is that customers' standards are far too high—and who expects castings to be sound anyway! In any case, it is an easy matter to throw the scrap back into the "pot" and remelt and cast it again. It has often been said that "Quality is everybody's business." It is proposed to show that the application of the control of product quality in the foundry can be just as rewarding, financially, as it has been already in other spheres.

Definition

In its current usage, the expression, control of product quality, denotes all those actions and activities which are necessary in an industrial organization, if it is to succeed in what is one of its main objectives—the achievement of requisite quality of product, at minimum cost. This last phrase will repay careful examination and consideration. First, what is quality? It has been defined as follows: Quality is a blend of aptness for purpose, satisfactoriness of functioning, and reliability compatible with the price which one is prepared to pay[1]. This definition leads to a far wider conception than has commonly been preached in this country, where quality control has too often been thought of as the application of statistical methods to the control of the dimensions of components being produced in large quantities, or to the quantitative attributes of goods or packages being produced by continuous processes.

The definition carries with it the implication of value. No one expects to be able to buy a Rolls-Royce car for the price of a Ford Anglia. But the man who buys an Anglia is entitled to expect a standard of finish and a level of performance and comfort and a reliability of an order in keeping with the amount of money which he has paid.

This brings us to a consideration of *requisite* quality. No one is in business for fun. He is in business to obtain self-satisfaction from a job well done, to provide lucrative employment for a number of people, and to make a profit. The order in which the foregoing reasons are listed and rated will vary with the individual, and could well provide matter for interesting debate. (Certainly the last motive is essential to the continued survival of the enterprise.)

If a product is to sell successfully in the face of competition, it is essential that its quality shall never fall below a certain level. Equally, if a firm is not going to cost itself out of business, it cannot afford to produce goods at a higher level of quality than the selling price justifies.

Variability

Two extremes of quality have been referred to —the lowest permissible, and a higher one. Here is one of the tenets of quality control—the realization that variability exists in the level of quality of our product—just as everything man-made is variable, in greater or lesser degree. Here too lies one reason why the early practitioners of quality control, about 30 years ago, failed to appreciate the wider implications of their subject. It is easy to appreciate that a machined dimension may vary between its upper and lower limits, and a great deal of work has been done by statisticians to evolve methods by means of which such dimensions can be controlled. What has been missed, not by the original pioneers, but by many of their disciples, is that the dimension itself, *and* its variability, *i.e.*, its tolerance, constitute a specification, and that in the case of many machine tools, the limitations of the process, *i.e.*, the ability of the machine to produce parts within that tolerance,

*Paper presented to the third annual Conference of the British Investment Caster's Technical Association (BICTA). The Author is chief quality engineer, aero-engine division, Rolls-Royce, Limited, Derby.

is well established and understood. In many other cases, such as the degree of cleanliness of the steel of a highly-stressed aircraft engine component, or the external appearance of an investment casting, or the freedom from casting defects of such a casting, it is necessary first of all to define the requirements—the requisite quality. All too often this is left until the troubles arise, and then debate between founder and customer ensues, at a lower or higher temperature depending upon personalities and circumstances.

Specification

By these arguments the first essential step in the control of product quality is arrived at, namely to ensure that adequate specifications exist. This requires that the requisite quality of the product shall be carefully determined, and fully and clearly defined. Too high a standard leads to loss of profit, too low a standard to loss of reputation and business. A moment's thought will bring the realization that the detail drawing seldom, if ever, provides the complete specification. It usually defines quite clearly and adequately the material, the shape, the size and the dimensional tolerances of the part, but any further specification of quality requirements is probably confined to a note stating that there must be no casting defects, or blowholes, or non-metallic inclusions. It may state that the part must be treated for cracks. But precisely how must it be tested? By what method? And how free from cracks or blowholes or pinholes must it be? All too often these days the draughtsman or designer has little knowledge of the difficulties and intricacies of the manufacturing process. Nor does he know, as a general rule, the standard of quality which is attainable by the method of manufacture. This is a common enough situation in the machine shops. It is likely to be intensified in the case of investment castings, where the processes are highly specialized, where knowledge is restricted to a relatively small number of people, and where the practice is still very much of an art. The laying down of adequate specifications is a most-important matter, and one of greater or lesser difficulty depending upon the circumstances of the case. In every instance it is necessary to make a study of: (*a*) What is needed to enable the product to fulfil its purpose, and (*b*) what variability is likely to arise in quantity production.

Practical Applications

From what has been said already, the range of quality attainable, and specified, must be such that the lowest level will always exceed that which is required, although in some cases—with motor car accessories for example—a calculated risk may be taken. Fig. 1 shows how costs could rise excessively if no windscreen wipers (for example) were ever to give trouble. By accepting the risk that some would give dissatisfaction, and deciding to replace these free of charge, the costs of quality assurance can be lowered. At the same time this must be balanced against the value of the goodwill and the reputation which might be lost. The determination of the point at which the two curves cross is therefore a matter of some nicety. In another case, say that a piece of jewellery, made as an investment casting, defects may be susceptible to correction by hand work. On the other hand, since quantities may be small and appearance all-important, nothing less than perfection may suffice. Yet again, say with an important component of a gas turbine engine, in an uncastable alloy, the arduous conditions of service demand a high degree

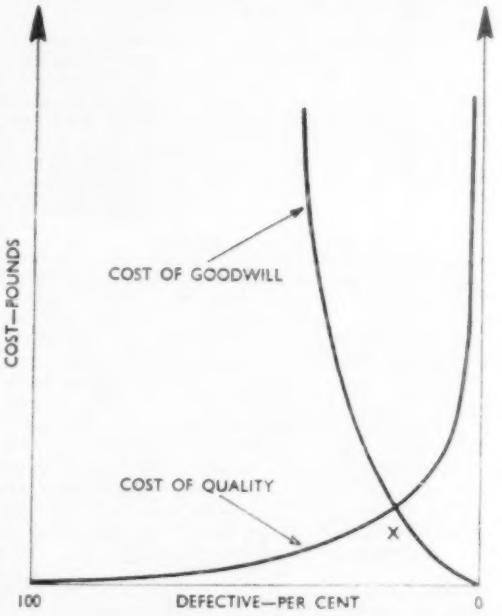


FIG. 1.—*Correlation of number of defective items tolerated, both with the cost of the necessary control to achieve this and also with the estimated corresponding variation in goodwill. The graph indicates a neutral position at point X. Although the exact form of the graph would vary with the type of item it well illustrates, the inverse relationship between cost and goodwill as perfection is approached.*

of integrity. The determination of the requisite standard may in this case require long and expensive engine testing. At the same time the high cost of the parts will justify every effort to match the capabilities of the process to the demands being placed upon it. This section of the overall quality activity, which specifies the quality of the product—the *end*—must also specify the *means* of ensuring that that objective has been achieved. This may require development work on methods of inspection—of measurement of awkward shapes, of non-destructive testing for cracks and porosity, and so on.

Inspection

The second essential step, is that of checking that the specified standards are met. This is the responsibility of the inspection department as it is commonly understood. Quite apart from its basic functions of checking the product against the specification (*i.e.*, the drawing plus any other qualitative standards which will have been laid down), the inspection department has other responsibilities which are not always realized. It should, for instance, plan the inspection operation, just as manufacturing operations are planned. It should determine where in-process inspections should be carried out, in order to reduce wastage of effort to a minimum. Methods of inspection and the equipment required should be specified. The production equipment should be checked to ensure that it is adequate for the job. The efficiency of operators should be checked, in cases where individual skill and responsibility play a part. Finally, reasons for rejection should be recorded and fed back to the production supervisor so that corrective action can be taken. This last is a most important function which plays a big part in the exercise of quality control.

Fault Removal

The third step is now reached, which is to:— Investigate and eliminate causes of non-conformance.

In each and every manufacturing organization it may be taken for granted that everyone concerned, inspector and producer alike, will be trying to eliminate causes of scrap, especially where these can be diagnosed quickly. There is a risk, however. In many concerns there exists a state of cold war between inspection and production. Production accuse inspection of scrapping parts, overlooking the fact that *they* produced the scrap, and that inspection merely rejected them against the standards laid down. In other firms, inspection reports to the production manager, and he may be impelled to put output first. In other words, he puts quantity before quality. Where these conflicts exist, then almost inevitably quality will fall. What is needed here is a more enlightened frame of mind which leads to a realization that quality control helps the overall productive effort, by helping to eliminate causes of defective work, at the same time maintaining the standard of quality, and reducing manufacturing costs. In order to take this third step, it will usually be necessary to probe more deeply into the causes of non-conformance than can be done by inspectors who are geared to the flow of production. This is where the setting up of a small quality engineering department will be justified. Lest this should arouse fears of increased expenditure in non-productive personnel, and accusations of "empire building," let it be said at once that such a department need never amount, numerically, to more than say five per cent. of the existing inspection strength. Moreover, its establishment will soon be justified by the economies which will quickly result if it carries out its duties properly. This point will be dealt with more fully below.

The duties of this small band are to ensure that an efficient system exists for the rapid and accurate recording of rejections and re-work; to investigate causes of that rejection and re-work; to feed back information to the production, material control or design departments for remedial action as necessary; and to assist generally in the diagnosis and remedying of faults. Depending upon the organization as a whole, that is, the capabilities and capacity of other departments to carry out those functions, this quality engineering section will also carry out more or less of the duties outlined as the first step—the laying down of adequate specifications. It was stated earlier that the requisite quality must be achieved at minimum cost, and this brings us to the fourth act:—

Economy

The final step is to ensure that the foregoing actions are carried out as cheaply as possible. It was American pioneers such as Dr. J. M. Juran[3] and Dr. A. V. Feigenbaum[4] who first drew attention to the overall cost of quality assurance, or, as it has been called, "the gold in the mine." This overall quality assurance function is all too seldom costed as a distinct part of the cost of production. It includes the cost of incoming material inspection and test; in-process and final inspection, including personnel and equipment and consumables (e.g., X-ray film, or penetrant fluid); process control; scrap, and re-working of defective parts; proof testing of the final product; replacement of defective parts under guarantee or warranty; and the cost of general productive inefficiency due to effort wasted on defective parts. Because it has not been usual to cost this function, there is little information regarding it. Most of the available information comes from the United States, where it has been estimated that the overall cost of quality assurance, as defined above, is of the order of 10 per cent. of the gross sales of the organization. From personal experience of a number of British firms, large and small, in widely differing industries, it can be said that this figure can safely be taken as a rough guide. Moreover, it has been shown quite conclusively in a number of American firms that this cost should and can be halved, by planned action along the lines indicated. Even if it should be found that the figure in any given organization were smaller rather than greater than 10 per cent. nevertheless it represents a quite substantial proportion of the net profit. The gains which are achievable represent, therefore, a large part of the profit margin, and are an important factor in the selling price of competitive products. Effective action along the lines indicated under the first three steps will result in appreciable economies, but there remain the other aspects of the quality assurance cost. Every facet of the overall quality activity should be kept under continual review. By treating it as a productive activity the efficiency of which can be reduced by the employment of modern management techniques, we can

FIG. 2.—*Statue produced by the Greeks 2,500 years ago in bronze by the lost-wax process.*

achieve similar savings to those which have been gained in America. The first action must be to determine accurately the total cost of quality assurance as defined above. Study of the scrap reports from the inspection department should enable the inspection force to be deployed to best advantage, in order to be most effective at critical points in the manufacturing sequence. Development work should be carried out on manufacturing processes to improve the efficiency. Automatic methods of manufacture and inspection shou'd be introduced where it can be seen that these will effect savings. The amount of inspection should be reduced, where possib'e, by the use of control charts and sampling schemes. Finally, inspection operations should be subjected to work study just as is done with production operations.

Foundry Product Quality

Having dealt at some length with the broad general principles of quality control, let us turn for a moment to the special problems of the investment caster. Lost-wax casting is one of the oldest methods of forming shapes in metal. It dates back to about 2800 B.C., and as a technique it has been in use continuously for a far longer period than most other methods which are in use to-day. Perhaps in this very antiquity lies the reason why the process still tends to be regarded as an art rather than as a technique, and why it has not constituted a more serious threat to those other, less sophisticated but more advanced methods of shaping—forging, pressing, and machining. One cannot help regretting that this should be so. Admittedly the process is complicated, but when we look at the achievements of the Sumerians nearly 5,000 years ago, at those of the Greeks and the Chinese 2,500 years ago, and of the English 850 years ago, it would appear that investment casting has not progressed at the same rate as competitive techniques in other fields. Wonderful work was being produced in the fifth century B.C., and Fig. 2 shows one impressive example—a statue of The Spinner, made by the Greeks. This stands nearly six feet high, and weighs barely 100 lb. It has been stated that a modern bronze statue would weigh nearly ten times as much. In China at about the same time, decorative work of a high order was being cast by the process, and about A.D. 1120 there was cast in this country the extremely beautiful Gloucester candlestick.[6] The process itself is a complexity of interdependent actions around which has grown up a fund of expertise which can of itself tend to be stultifying. The longer a method has been in use, the more does it become accepted as adequate. and the less are people inclined to look for improvements and modifications in the process. Added to this, we have the situation that the process is capable of producing parts, albeit sometimes at the cost of high scrap, which cannot be produced, in the chosen materials, by other means. In circumstances such as these it has happened, in the recent past, that the major advances in technique have been made only when newcomers have entered the industry. These people have brought to the problems a fresh outlook, and a freedom of thought unfettered by a traditional respect for the *status quo*. These individuals are relatively rare, and for this reason we turn to the formalized approach developed by the modern practitioners of quality control.

Making a Start

In these days of financial stringency no industrial executive is going to initiate a project unless he can see a return for his money. The first act in a programme of quality control should be therefore the determination of the amount of scrap, and its cost. This may present a task of some difficulty, since too many people have become so inured to the existence of a high scrap figure that they regard it as inevitable. Others may feel that it reflects upon their own ability, and may try to suppress the truth—and what easier place than a foundry in which to lose the debris of spoilt castings amongst the heap of discarded runners and feeders! Others may be entirely unconvinced of the value of the exercise. In fact, in quite recent times, the author was assured by a senior foundryman that scrap did not matter as it went into the overheads! Nevertheless, the effort should be made to determine as accurately as possible the cost of the scrap. This figure should include the losses incurred by the production of material which cannot be re-used, especially in the case of those expensive heat-resisting alloys which so easily lose their properties. This figure, once obtained, cannot fail to interest the executive. Next, an act of faith is required. There must be the conviction, based upon the examples of those firms who have already achieved success, that this scrap cost can be reduced considerably, at little expenditure of manpower. At this stage it will pay to allocate some one individual to concentrate upon the collection and study of data on the causes of scrap,

and at what stage those causes arise. This will usually entail no more than the planning of a simple system of recording which should not be beyond the capabilities of the existing inspection organisation. It is likely to involve little increase in work load on the inspectors, but it can be expected that a good deal of persuasion may be necessary. It is here that the active interest and encouragement of a senior executive can be of great value.

Results

Once this information regarding the causes and incidence of scrap becomes available, quite dramatic improvements may be possible. In some recent instances with which the Author has been familiar, the production people concerned have found themselves provided, for the first time in their lives, with the information which is necessary to enable them to carry out their duties effectively. Their interest and their professional pride have been awakened, and it is they, with their intimate knowledge of the processes, who have been able to overcome the difficulties. In other cases, their investigations have shown that the process is incapable of meeting the demands of the designer. Action has then taken the form of a development of the process, or of a mitigation of the demands of the designer, to a more realistic level. Once this initial success has been achieved, the decision must be taken on the future scale of the quality control activity. Here it is necessary to utter a warning. There have been those who put the means before the end. Starting with the too-earnest advocacy of statistical methods, more recently there have been those who press for the setting up of a quality control department, with the emphasis on control. It is as well to remember the exhortations of those pioneers of 30 years ago —Dr. Dudding in this country, and Dr. Shewhart in America that quality control is an attitude of mind. It is also truly said that it is everybody's business.

Conclusion

This last warning is conveyed in the following quotation from a recent paper[7] which summarizes the general approach to the subject which has been outlined above.

"The exercise of full control of product quality will require the application of common sense, engineering, inspection, proving (*e.g.*, by testing) and statistical methods of analysing manufacturing performance, each in greater or lesser degree according to the nature of the product, its value, its purpose, the rate and scale of its production, the personality of the organization, and the capabilities of the personnel concerned."

The basic steps which must be taken for full control to exist have been outlined in the body of this article. It is important to realize, however, that these acts will vary considerably in individual importance according to the needs of the enterprise under review.

"There is no simple universal solution, nor any single ideal form of organization. The precise title under which each of the basic acts is operated is of no significance, and it may well vary in different organizations."[7]

The success which has followed action along the lines indicated, notably in the USA, in Japan, and in other countries, has led to official recognition of the importance of the subject by the Governments of these countries. It is hoped that sufficient has been said to enable firms in the investment casting industry to evolve their own pattern of control, suited to their special requirements. It is hoped too, with a degree of confidence, that those firms who do put these precepts into practice will show that the ancient technique of lost-wax casting is still capable of challenging competitive techniques which have been developing so rapidly during this current century.

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[APPENDIX]

Guide to the Control of Product Quality

The purpose of an industrial organization is to achieve the requisite quality of product, at minimum cost.

Requisite quality is defined as that which is necessary to ensure customer satisfaction, by achieving a given standard of reliability, or fitness for purpose, in the product. The exercise of full control of product quality will require the application of common sense, engineering, inspection, proving (*e.g.* by testing) and statistical methods of analyzing manufacturing performance, each in greater or lesser degree according to the nature of the product, its value, its purpose, the rate and scale of its production, the personality of the organization, and the capabilities of the personnel concerned. The chart overleaf indicates the basic acts to be carried out for full control to exist, but these acts will vary considerably in individual importance according to the needs of the enterprise under review.

There is no simple universal solution, nor any single ideal form of organization. The precise title under which each of the basic acts is operated is of no significance, and it may well vary in different organizations.

The chart should be used as a check list to ensure that no essential step has been overlooked, and as an aid to the

Control of Product Quality

diagnosis of the needs of the organization. Items marked * are definitely the responsibility of Inspection and represent the great bulk of the total personnel required.

Thus the control of product quality can be subdivided into three phases as tabulated below:—

(1) *Ensuring that Adequate Specifications exist.*

The overall quality concept requires that the requisite quality of product shall be carefully determined, and fully and clearly defined.

Too high a standard leads to loss of profit, too low a standard to loss of reputation and business.

This function requires a study (*a*) of what is needed to enable theproduct to fulfil its purpose, and (*b*) of the variability likely to arise in quantity production. Reliability and customer satisfaction will ensue only when the range of quality is such that the lowest level will always exceed that which is required of the product.

(*a*) Study the needs of the product in the light of all available knowledge. Analyze records of prototype trials and of service complaints of similar products, to determine necessary level of quality.

(*b*) Determine variability likely to arise in production, by observation, analysis of plant capability, rig testing, life- or fatigue-testing, as appropriate.

(*c*) Ensure that acceptable quality level is specified clearly and unequivocally, based upon the necessary level of quality determined from (*a*).

(*d*) Check engineering drawings, specifications of materials and processes, and quality specifications, to ensure that together they convey to the manufacturer the a.q.l. of (*c*).

(*e*) Develop methods of inspection, non-destructive testing, and proof testing as necessary to enable the a.q.l. to be achieved.

(2) *Checking that the Specified Standards are met.*

This is the responsibility of the inspection department as it is commonly understood, excepting that the inspection audit function should ideally be carried out by an independent body.

*(*a*) Prepare inspection plan, stipulating stages in production process at which inspections shall be carried out, and defining method and equipment.

*(*b*) Check production equipment, *e.g.* machine tools, jigs and fixtures. Are these adequate to enable the required standards to be met?

*(*c*) Control operations and processes to the standards laid down.

*(*d*) Check the product against specification.

*(*e*) Accept or reject the product.

*(*f*) Record reasons for rejection.

*(*g*) Overcheck systems and organization of vendors and sub-contractors.

*(*h*) Overcheck products of vendors and sub-contractors.

*(*i*) Check ability of operators carrying out critical work, *e.g.* welders.

(*j*) Check efficiency of inspectors.

(*k*) Conduct inspection audit or quality assurance checks on finished products.

(3) *Investigating and Eliminating Causes of Non-conformance.*

Inspection and production personnel will naturally take all possible action to eliminate causes of scrap, where these are appreciated and can be diagnosed quickly. Many problems will require a fuller investigation than can be made by those concerned with the day-to-day running of the Shop, however, and it will usually be found more expedient and effective to set up a small Quality Engineering activity with time to study these problems thoroughly.

(*a*) Set up system for the rapid and accurate recording of rejections and rework.

(*b*) Investigate causes of rejection and rework.

(*c*) Feed back information to production, purchase, or material supplier for remedial action as indicated.

(*d*) Feed back information to design for drawing change where necessary.

(*e*) Develop new methods of measurement and non-destructive testing as required for earlier identification of defective work.

(4) *Economy of Operation.*

Although action along the lines already indicated will result in considerable economies, minimum cost for requisite quality can only be achieved by regarding the overall cost of quality assurance, *i.e.* inspection, testing, scrap and rework as involving a definite proportion of the total manufacturing cost which can and should be reduced.

Every facet of the activity should therefore be kept under constant surveillance and treated as a productive activity, the efficiency of which can be increased by the application of modern management techniques.

(*a*) Determine total cost of quality assurance, *i.e.* inspection and quality control labour, equipment, scrap and rework, testing.

(*b*) Determine stages at which scrap arises. Re-deploy inspection force to increase its effectiveness at critical points in manufacturing programme.

(*c*) Do not increase inspection effort beyond the point of economical return.

(*d*) Conduct tests on rejected parts to determine acceptability on a concessionary basis.

(*e*) Develop processes to improve capability at no increase in cost.

(*f*) Develop more efficient and automatic methods of manufacture and inspection to reduce the risk of human error.

(*g*) Reduce amount of inspection by use of control charts and sampling schemes, where possible.

(*h*) Apply work-study to inspection operations.

Permission for Foundry Refused

Mr. Stewart Anderson, of Stirling, in a letter to the planning committee of Stirling Town Council, asked that they reconsider their decision of refusing planning permission for the change of use of premises at 5, Main Street, St. Ninians, from a factory to a brass foundry. Mr. Anderson stated that all heating was done in this case by oil with no smoke or flame emitting from the building. The proposed foundry was to be on a small scale and the largest machine would be of about the size of a domestic cooker and noise and nuisance would be negligible. The committee recommended that their previous decision refusing planning approval be adhered to.

PRINCE-SMITH & STELLS, LIMITED, Keighley, Yorkshire, a member of the Stone-Platt Industries group, have secured at the Poznan Fair, an order for their "New Continental" worsted textile machinery to the value of £400,000.

Lower Profits for Dorman Long

Trading profits for the half-year to March 31, 1961, of Dorman Long & Company, Limited, iron and steel manufacturers, construction engineers, and bridge builders, have been running at a lower level than for the same period last year, the directors announce. The interim dividend is maintained at 3½ per cent. in respect of the year to September 30, 1961. A total of 10 per cent. was paid for 1959-60.

Ingot production for the half-year increased from 1,159,662 tons for the 1959-60 period to 1,202,264 tons. Steel prices were reduced in February, 1960, and costs of production have since increased through advances in coal prices, wages, etc. In the result, margins for depreciation and profit on iron and steel products are reduced and trading profits have consequently been running at a somewhat lower level.

At present, the directors add, there is a reduced forward order-book for all steel products. The engineering works are fully employed, but prices are low owing to keen competition.

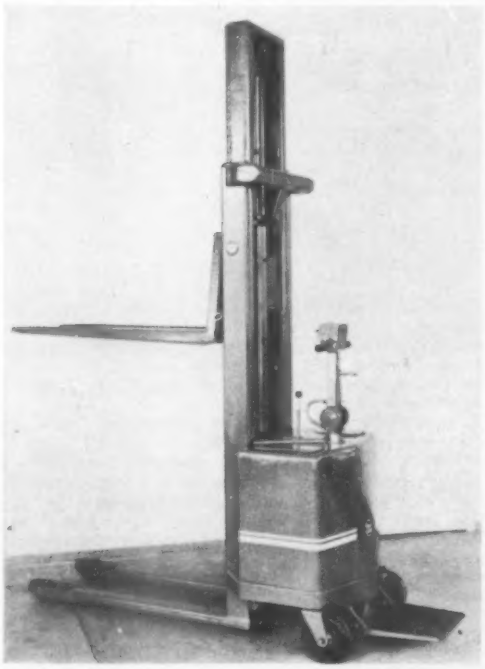
Equipment & Supplies

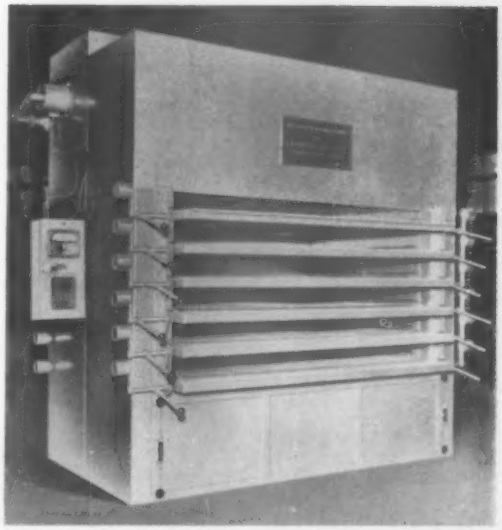
Stacking Truck

A compact battery-operated pedestrian-controlled stacker (Fig. 1) of Swedish manufacture has been introduced into this country by the sole distributors, Rolatruc, Limited, 207, Hanworth Road, Hounslow, Middlesex. Known as the BT powered stacker, it is claimed that it has a lifting capacity of 2,200 lb. at 24-in. load centre with heights of lift ranging from 92 to 132 in. It is powered by two 6-volt traction batteries with a 350 a.h.c. connected in series which operate a motor built into the drive wheel and provide a maximum speed of 2½ m.p.h. laden and 3 m.p.h. unladen. A separate motor coupled direct to a gear-type pump operates the hydraulic lifting mechanism which is fitted with a safety valve as a protection against overloading. The driving controls provide two speeds forward and two reverse. The hydraulic lift is operated by a push button, and a horn button and an ignition-type switch complete the control assembly. The steering handle can be moved 100 degrees in either direction and the manœuvrability of the truck is such that the aisle width needed to stack 48-in. wide pallets is stated to be only 79 in.

The overall length of the truck with the standard 45-in. forks and the platform in the raised position is 75 in. Width is 31½ in. The overall height of the model with 124-in. height of lift is 83 in. If required a free lift equivalent to half the total lift height can be provided for stacking in places where headroom is unusually restricted.

FIG. 1. — *Battery-operated, pedestrian-controlled stacker now available in this country.*





Oven designed and manufactured by G. & R. Gilbert (Industrial), Limited. The doors of the unit have been opened to show the internal details, although when in use, only one at a time would normally be opened.

Baking Oven

The illustration above shows a new pre-heating oven designed and manufactured by G. & R. Gilbert (Industrial), Limited, Hackbridge, Surrey, for baking plastics, but obviously of equal applicability for foundry cores or "biscuits." As illustrated, the oven has doors at both the front and back of each compartment. These are lever-actuated and counter-balanced and can be lifted off and the shelves removed. This arrangement allows either one large or several small pieces of work to be handled. The bottom panel of the oven can also be removed and the space used for re-heating and drying. Both gas and electrically-heated units are available, the normal sizes being 3 ft. by 4 ft., 3 ft. by 6 ft., and 4 ft. by 8 ft., although the company also manufacture ovens to customer's specifications.

Shotblasting on Site

R. J. Richardson & Sons, Limited, Commercial Street, Birmingham 1 (one of the Staveley Coal and Iron Company, Limited, group) is now operating a mobile site shotblasting service throughout the UK. Utilizing the varied experience gained from contract blasting in the firm's shops since 1890 and making a substantial investment in mobile plant, it has been possible to ensure that consistent standards of finish can be obtained on site which, it is claimed, are equal to those carried out in permanent shotblasting installations.

The equipment employed is transported to sites on one 7-ton B.M.C. truck and one Bedford 7-ton four-wheel-drive truck, each towing a 7-ton, four-wheel trailer. These trailers, which are fitted with winches and low-loading tail-end-gates, carry the power units

Equipment and Supplies

for the equipment, the first trailer carrying a Leyland/Brush 90-kva. diesel generating-set to provide electrical power for the operation of driers, recovery plant and dust-suppression units, whilst the second transports a Consolidated Pneumatic type 600-RO-2 Rolls-Royce-powered rotary Power Vane compressor which delivers 600 cfm. of compressed air at a working pressure of 105 lb. per sq. in., for the operation of the Tilghman shotblasting equipment, this comprising shot-feeding equipment, hoses, guns and recovery plant.

Refractory Application

Causeway Reinforcement, Limited, Five Ash Works, Northfleet, Kent, have introduced a new method of fixing Hexmetal (a honeycomb structure made of strip metal) in monolithic refractory linings. The company claim that its use results in considerable saving in time and labour and that it is being adopted for many refractory lining applications. A preformed mesh of Hexmetal is supplied with lugs of the appropriate length secured in place and the whole assembly can then be anchored—in one welding operation—to a furnace shell. "Gunning" of plastic refractory mixture is then carried out in one operation by "firing" through the mesh. The material is available in steel, stainless iron, aluminized steel strip or non-ferrous material. Another advantage claimed by the makers is that the honeycomb shape acts both as a binder and separator and considerable impacts can be absorbed without the refractory surface becoming damaged.

Magnetic Vibrators

Magco Limited, Lake Works, Portchester, Hants, have long felt that a reversal of the static to fixed-weight ratio of electro-magnetic vibrators could result in a considerable increase in efficiency and at the same time enable a reduction in production costs. With their new design therefore, the bottom unit, which carries the armature, is comparatively light whilst the upper, moving unit, consists of a casting on which is carried the laminations and coil.

For example, with an original type vibrator weighing 100 lb., the moving top unit weighed 33 lb. whilst, with the new conception, it would weigh 66 lb. The smaller vibrator units operate twice per cycle thus giving 6,000 vibrations per min. on a 50-cycle supply or 7,200 per min. on a 60-cycle supply. Larger models operate on a half-wave system, giving 3,000 vibrations per min. on a 50-cycle supply and 3,600 on a 60-cycle supply. The vibrators are especially useful where a difficult or damp material will not flow freely forward out of a hopper.

Temperature Control: A recording impulse-type thermostatic control designed to bring the advantages of modulating control to electrical-heating equipment has been developed by the Partlow Corporation of New York and designated Model RES. It is designed for use where process temperatures are critical and "overshoot" (or "undershoot") cannot be tolerated. It is also recommended for applications where the capacity of the electrical-heating elements is large in relation to the work load, risking serious overshoot with conventional two-position control. As a result, it is claimed that the time-temperature curve of a process controlled closely approximates a smooth line. The instrument records temperatures throughout the cycle on a 10-in. dia. calibrated chart. Further information is available from Ad. Auriema, Inc., 85, Broad Street, New York 4, N.Y., or 172A, Rue Brogniez, Brussels 7, Belgium.

Hardenability: Metallurgical Services, proprietors, Planned Products (Metallurgy), Limited, Reliant Works, Betchworth, Surrey, announce an end-quench unit for hardenability determinations, the overall dimensions of which are:—height 23½ in.; diameter at base, 17½ in., and diameter of body, 12 in. The apparatus has been designed to be universal in that interchangeable specimen holders are available for diameters from 1 to ½ in. The jet is changeable so that if it is desired to test specimens smaller than ½ in. dia. a smaller jet may be fitted. The specimen holes in the carriers are arranged to give $\frac{1}{32}$ in. clearance, and the holes are countersunk on the underside to minimize contact with the specimens. The carriers maintain the quenched end of the specimen ½ in. above the jet orifice.

Anti-static Boot. A new type of boot, capable of dispelling static build-up, was demonstrated on the stand of Thos. W. Ward, Limited, Albion Works, Sheffield, at the recent RoSPA Exhibition at Scarborough. This footwear should be of particular interest to such industries as petroleum, chemical explosives, etc., where extra safety against highly inflammable materials is required. The boots are oil-resistant and are said to have longer wearing soles than normal footwear.

Emergency-stop Device: An emergency-stop device for conveyors, which is operated by a beam of light and a photo-electric cell, is now being manufactured and marketed by Hird-Brown, Limited, 244, Marsland Road, Sale, Cheshire. It is said to be simple to instal and in single units can be used with ray lengths of up to 75 ft.—longer lengths can be accommodated by overlapping units. The device itself has also been arranged to "fail safe," so that any component failure will stop the conveyor.

Cutting Blowpipe: British Oxygen Company, Limited, Bridgewater House, St. James's, London, S.W.1, announce the Firefly hand-cutting blowpipe—a unit weighing only 12 oz. and stated to be capable of cutting mild steel up to ¾-in. thick. Initially, nozzles will be available for use with acetylene, but the early introduction of a range of propane nozzles is also planned.

Aluminium Solder: Tin-A-Lum, a fluxless aluminium and universal solder, is now available from Industrial Synthetics (Overseas), Limited, 64-66, Marlborough Grove, London, S.E.1. The solder melts at 180 deg. C. and has a range of up to 350 deg. C. for specific requirements.

FORTY-TWO REPRESENTATIVES from 23 north-eastern companies recently watched a demonstration of the new Berk 61 metal-spraying pistol at the Middlesbrough Works of Dorman Long (Bridge and Engineering) Company, Limited. The demonstration was organized by the coating division of F. W. Berk & Company, Limited, who have developed the pistol to meet the needs of contractors who need fast spraying equipment either to cover large areas of structural steelwork, or to match in with automatic grit-blasting installations.

Foundry Art and Craft Exhibition

Casting from all sections of the founding industry were displayed at last month's three-day Exhibition of Foundry Art and Craft, organized by the Department of Metallurgy of the University of Birmingham, and staged in the University's Great Hall. The many interesting exhibits on show—contributed by individuals, firms and associations—ranged from a bronze bust of Epstein to precision die-cast components, and there were also displays of foundry equipment and supplies. Of particular interest to the many students who attended was the "live" moulding demonstration staged by F. H. Lloyd & Company, Limited, of Wednesbury. Some of the exhibits are illustrated alongside on the art-founding stand; they included a replica of Cellini's "Perseus." A general view of the Exhibition in its impressive setting is shown in the photograph below.

Shell Sand-coating Unit. Fordath Engineering Company, Limited, Brandon Way, West Bromwich, has issued an eight-page well-illustrated brochure which covers the outstanding features embodied in the design of their equipment for making pre-coated resin sand for shell moulding and coremaking. An excellent description is given of the plant and its components, and, moreover, due regard has been paid to the requirements of Continental and American users. An Italian version of the brochure has been produced by the company in which only the metric system is used, and in America, Shalco, the distributors of the equipment there, have produced their own version based on the British original. For American users details are given of the type of motor used for the sand cooling and elevating equipment and the mixer. With expanding business on the Continent, the company is shortly to produce a German version of the brochure.

Recording Counters. In list 143/1, the Cambridge Instrument Company, Limited, 13, Grosvenor Place, London, S.W.1, describe an interesting line of recording counters. They are circular in shape, often furnished with multiple pens, and record the performance of machines and furnaces. In the case of the latter, quite often both pressure and temperature are simultaneously plotted. Such instruments could with advantage be applied to foundry plants and processes.

Personal

After more than 42 years service with the General Electric Company, Limited, 31 of them as manager of the export sales department at the Witton Works, Mr. J. F. PRINCE retired at the end of last month. Mr. K. D. STARR, who joined GEC in 1947 and subsequently became director of the British General Electric Company of Central Africa (Pvt), Limited, Salisbury, Rhodesia, is Mr. Prince's successor.

Mr. F. HOLLOWAY, at present secretary of the Workington Iron and Steel Company branch of the United Steel Companies, Limited, has become secretary and office manager from July 1, following the retirement of Mr. W. MCGREGOR. From the same date, Mr. G. HIRD is appointed agent responsible for the company's mining and quarrying properties in Cumberland, following the retirement of Mr. J. S. BOOTH.

The Holman Group of Camborne, Cornwall, has appointed Dr. H. J. PHELPS, M.A., D.PHIL., as consultant to two of its companies, Maxam Power, Limited, and Goodyear Pumps, Limited. Dr. Phelps will continue to act as an independent consultant to the De La Rue company, to whom he was appointed technical adviser in 1956, and also as a director of Ets. Wyns-Bristol, S.A., manufacturers of paints and printing inks in Belgium.

Mr. A. D. THOMSON has been appointed deputy managing director of Edwin Danks & Company (Oldbury), Limited. Since 1958 he has been head of the atomic energy section of Babcock & Wilcox, Limited, the parent company, being responsible for tendering on nuclear work, and for the financial control of nuclear contracts. Mr. C. H. G. HAYWARD and Mr. H. HARDING SMITH have been appointed directors of Edwin Danks.

Mr. ROBERT ALLEN COURTMAN, senior executive at Armstrong Whitworth Aircraft, Limited, has been appointed production manager of Hawker Siddeley Aviation, Limited. Mr. Courtman will be responsible for production co-ordination at all HSA's operating companies and will report directly to the chief executive of HSA, Mr. J. T. Lidbury. Mr. Courtman's duties as senior executive at AWA will be taken over by Mr. G. E. HAYWARD.

Alfred Ellison Limited, announce that Mr. J. WINFIELD has joined their sales staff and is now responsible for their sales and consultative service for grey-iron castings in the Midlands. Mr. Winfield was previously sales manager of Idoson Motor Cylinder Company, Limited, subsequent to serving Qualcast (Wolverhampton), Limited, in the same capacity. From 1948 to 1956, he represented Dartmouth Auto Castings, Limited, in the Midlands and North of England.

The European Committee of Foundry Associations announce that Mr. M. HOMBLAT of Denmark will succeed Mr. DIONISIC ESCORSA as president in 1962. Dr. J. G. PEARCE has been elected chairman of a subcommittee to deal with the instruction of mechanical engineers in the use of castings. Mr. M. M. Hallett is the chairman of committee No. 7 (a), on Market Research, which covers the competition experienced in Europe from plastics, weldings, forgings and other processes.

Balbardie, Limited, Edinburgh, announce that on July 1, Mr. K. M. EVANS became managing direc-director of the company, succeeding Mr. D. W. L. MENZIES who will continue as chairman. Mr. Evans joined the company at its inception as manager, afterwards becoming general manager and a director of the company. Balbardie, Limited, are manufacturers' agents and are associated with North British Steel Company, Limited, of Bathgate, and Bonnington Castings, Limited, of Leith.

Mr. ALFRED PARRAMORE, joint managing director, F. Parramore & Sons, Limited, ironfounders and engineers, Chapeltown, Sheffield, has been appointed chairman of the firm, in succession to his brother, Mr. ERNEST PARRAMORE, who was also joint managing director, and died recently at the age of 74. Mr. Alfred Parramore has been with the firm since it was founded in 1904 by his father. Mr. E. F. G. PARRAMORE, son of the late Mr. Ernest Parramore, general manager since 1939, has been appointed managing director.

Mr. O. C. KERRISON has retired from the chairmanship of the Paterson Engineering Company, Limited, and from the directorate of the associated companies in the group, after 50 years' service. He joined the late Mr. William Paterson as his personal assistant in 1911 when the Paterson Engineering Company was a small private company and became a director on conversion to a public company in 1933. In 1955, Mr. Kerrison became managing director and in 1960 chairman. Mr. JOHN V. SHEFFIELD has become chairman of the company.

Mr. S. WEBSTER, departmental director in charge of lawnmower production of Qualcast, Limited, took over on July 1 the entire control of the lawnmower sections of the group comprising: Qualcast, lawnmower division; Suffolk Iron Foundry (1920), Limited, and Follows & Bate, Limited. He replaces Mr. H. CLARKE as chairman of Follows & Bate and chairman of Suffolk Iron Foundry. Mr. Clarke who on July 1 became assistant managing director of the parent company, Qualcast, has resigned from the boards of the lawnmower subsidiary companies.

Mr. ROBERT M. BELLINGHAM, foreman of the metal preparation and machine shops of Smith & Wellstood, Limited, Bonnybridge, has retired after 51 years' service with the company. He joined the firm straight from school in 1910, starting as an apprentice fitter and for the next 36 years worked a wide range of goods from register grates to heat storage cookers. He was among the first to fit ESSE cookers and he was in fact the first fitter to be employed in the heavy-duty cooking equipment shop when it was started during the last war. In 1946 he was appointed foreman.

Mr. ALFRED JONES, formerly an ironfounder in Farnworth (Lancs), celebrated his golden wedding on June 29. It was in 1913, after 17 years with the local co-operative society as a grocer that Mr. Jones entered the iron foundry business in Farnworth with his father and three brothers. Eventually, they owned four foundries, two in Farnworth, one in Little Lever and one in Pendlebury. Sixteen years ago two of the foundries were sold to Mather & Platt, Limited, and control of the others was taken over by Mr. Jones's nephews. Mr. Jones also has behind him a long record of public service. He was elected to the Farnworth Urban District Council in 1928, and served continuously for 29 years. He was chairman of the Council in 1938-39, the year before Farnworth became a Borough and in 1943 was elected Mayor. He was chairman of the finance committee for over 20 years.

Hepworth & Grandage Open £200,000 Laboratories

The Lord Mayor and Lady Mayoress of Bradford, Councillor and Mrs. B. W. Berry, attended the official opening ceremony of the new £200,000 engineering and metallurgical laboratories of Hepworth & Grandage, Limited, at their St. John's Works, Bradford, recently, which have been built to further research and development in engineering. Mr. G. C. Hepworth, managing director of the engineering components division of Associated Engineering, Limited, who opened the new premises in the absence of Mr. Norman Brearley (deputy chairman, Associated Engineering), on account of ill health, said: "I am convinced our future in the sixties depends on technical superiority and that is the reason we have established these laboratories. Eventually we shall have the finest research facilities, within our industry, in the world—and that includes America."

The new premises consist of a three-storey building located next to the administrative block. Engine research occupies the basement, together with the works photographic department and the engineering and metallurgical workshop. The ground floor is given over to metallurgical and physical testing laboratories and the first floor is taken up by the design drawing office and dark rooms.

Better Sales Outlook for Metal Box

Reduced home demand in the last few months of last year is likely to continue for the first few months of 1961-62, says Sir Harold Roxbee Cox, chairman of the Metal Box Company, Limited, in his statement to shareholders. There are, however, already signs of home demand increasing later in the year and the board would be disappointed if overall sales do not surpass the record for the year ended March 31, 1961. Although overseas subsidiaries show every sign of continued progress, the first half year is not expected to be as good as in the six months to last September.

Sir Harold says that it will be difficult to maintain profit margins in the face of increasing costs, but the board has no doubt that aided by technical advances, new levels of productivity will be achieved. Both in sales and profits the overseas company had an outstanding year in 1960-61 and was responsible for all the increase in the company's profit. The home performance was "unremarkable." As previously reported, group net profit of £4,843,287, compared with £4,459,461, and the 12 per cent. dividend with the equivalent of 10.9 per cent.

The creation of new facilities at home to meet increasing demand required expenditure on buildings and equipment of £6,349,000, and expenditure on a similar scale is likely in the present year, he states.

A.P.V. Presentation to Crawley College

A 15-lb. capacity Morgan gas-fired crucible melting furnace was recently presented (Fig. 1) by A.P.V.-Paramount, Limited, to the Crawley College for Further Education to mark the inauguration of the latter's foundry department and also the occasion of the Duke of Edinburgh's Commonwealth Technical Training Week. The formal presentation was made by Dr. R. J. S. Seligman, president of the company, supported by Mr. J. F. B. Jackson, managing director of A.P.V.-Paramount, Limited. The furnace was received on behalf of the College by Miss Joan Quennell (M.P. for Petersfield) who is a College Governor. Throughout the Commonwealth Technical Training Week, the foundry department of the College held moulding and casting demonstrations (Fig. 2) given by Mr. E. B. Smith and Mr. H. Chaplin, assisted by four apprentices, all of A.P.V.-Paramount, Limited, whose steelfoundry is at Crawley.

FIG. 1 (*left*)—*Gas-fired crucible melting furnace being presented by Dr. Seligman to Miss Joan Quennell, who received it on behalf of the Crawley College for Further Education.* FIG. 2.—*Mr. Chaplin pouring the first melt from the new furnace, watched by Miss Quennell (left), with Dr. Seligman, Dr. Siklos (principal of the College) and Mr. J. F. B. Jackson. The first casting, presented to Miss Quennell, was a paperweight.*

[*Photographs by courtesy of the Crawley Courier and the Crawley and District Observer respectively.*]

News in Brief

THE AMALGAMATED ENGINEERING UNION has placed an order with International Computers and Tabulators, Limited, for an I.C.T. type 555 electronic computer and ancillary equipment to the value of £67,000.

A NEW COMPANY—Massey-Ferguson-Butler, Limited—is being formed by Massey-Ferguson, Limited, and the Butler Manufacturing Company of Kansas City, to market the range of Butler-designed grain-handling, drying and storage facilities, bulk feed bins, and farm building in the United Kingdom and overseas.

HEAD WRIGHTSON IRON AND STEELWORKS ENGINEERING, LIMITED, a subsidiary of Head Wrightson and Company, Limited, Thornaby-on-Tees, figure jointly with Société Fives Lille-Cail in a £1,000,000 contract for a sintering installation. This will involve 3,000 tons a day for a minerals-treatment plant at Saizerais, in Lorraine.

THE COST OF THE INITIAL DEVELOPMENT of the project at Irvine, Ayrshire, of Skefco Ball Bearing Company, Limited, Luton, will be between £2,000,000 and £3,000,000, it was stated on June 20 when the foundation stone of the new office block and administration centre was laid by the company's chairman, Sir Victor Mallet.

ENGLISH STEEL CORPORATION, LIMITED, Sheffield, are seeking planning permission to develop a four-acre quarry site adjacent to their sports ground at Shiregreen Lane, Sheffield. If the firm is able to buy the site from the Sheffield Brick Company, Limited, and the city council does not object, they will fill the quarry, level off the surface and grass it.

THE CULMINATION of two years' diversification and expansion by the handling equipment firm of Dickson & Mann, Limited, Armadale, West Lothian, was marked last Friday by the opening of a new 15,000 sq. ft. extension to their Bathville Steel Works. The ceremony was performed by Lord Polwarth, chairman of the Scottish Council (Development & Industry).

DRYSDALE & COMPANY, LIMITED, Glasgow, have received an export contract worth over £200,000 for the supply of pumping and ancillary equipment for a new pumping station on Hong Kong Island. The pumping station, initiated by the Hong Kong Water Department, under their Shek Pik water supply scheme, is one of the largest pumping stations of its type ever envisaged.

C. A. PARSONS & COMPANY, LIMITED, electrical engineers, Newcastle, have opened a new mechanical research laboratory at their Heaton works. Mr. J. L. Gray, turbine-plant design engineer of the Central Electricity Board, performed the opening ceremony on June 14 by starting an experimental steam turbine which has been designed to investigate the performance of low-pressure blading.

ALFRED HERBERT, LIMITED, machine-tools and equipment makers, Coventry, opened a new branch in Leeds on July 3 to provide an engineering service in Yorkshire (apart from the western extreme), Northumberland, Cumberland, Westmorland, Durham, part of Lancashire, large areas of Lincolnshire and Nottinghamshire, and north east Derbyshire. The new premises are at 311, Dewsbury Road, Leeds 11.

OVER 1,000 INDUSTRIALISTS visited the laboratories of the British Iron and Steel Research Association in Sheffield on the two "open days" of June 15 and 16, when the work of three of its five divisions was on general display. Among guests on the first day was Mr. Denzil Freeth, Parliamentary under-secretary to the Ministry of Science, who toured the laboratories accompanied by Sir Charles Goodeve, director of BISRA.

UP-TO-DATE PARTICULARS about minimum or standard rates of wages and of the length of the normal working week in more than 200 industries and services in the United Kingdom are given in the fifteenth edition of "Time Rates of Wages and Hours of Work" dated April 1, 1961, compiled and published by the Ministry of Labour. It is available from H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 16s. 9d., post free.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, bought the Marske-by-Sea Ordnance Depot at a public auction at Redcar on June 27 for £190,000. The depot which was sold as a whole, with the exception of two buildings subject to a tenancy, comprises a site area of 30,538 acres with 23 permanent buildings. There is a private rail siding and loading platform. The area was used as an aerodrome in the first world war and as an ordnance factory in the last war.

THE EAST AND WEST RIDINGS Regional Board for Industry reported a large decrease in unemployed at their monthly meeting in Leeds on June 20. The number of unemployed was down to 16,635—a decrease of 2,118 in a month. At the same time last year, the unemployed totalled 21,457. Only 54 boys and girls are still on the register out of 11,000 known to have left school since Easter. Main increases in employment included 400 in engineering, and 200 in steel.

THE BOARD OF TRADE and the Industrial Safety (Personal Equipment) Manufacturers' Association of Great Britain have collaborated to organize a display of British industrial safety products at Interschutz, the International Exhibition of Fire Fighting Apparatus and Safety Equipment, in Cologne, which opened on June 23. The Board of Trade stand, which covers 2,000 sq. ft., includes individual displays by nine firms and an enquiry bureau to be manned by the trade association.

THE TRADERS ROAD TRANSPORT ASSOCIATION announce that administrative difficulties in connection with the issue of T.I.R. Carnets have been overcome. The Carnets enable commercial vehicles travelling from Britain to Europe to pass through intermediate customs posts without examination of the load, which is sealed before leaving Britain and only opened at the appropriate customs post in the country of destination. The Association is now in a position to issue Carnets to member-firms.

TWO FURTHER CONTRACTS, worth more than £100,000, have been awarded Head Wrightson & Company, Limited, of Middlesbrough, by Colvilles, Limited. One is for a steel-plate levelling line for the firm's Ravenscraig Works designed to handle hot-rolled plate up to a maximum thickness of $\frac{7}{8}$ in., 5 ft. 3 in. wide and 30 ft. long; the other order covers two levelling and oiling lines for Colvilles' Smith and McLean division at Gartcosh works and will handle sheets cut from cold-rolled strip in gauges from 0.001 in. to 0.111 in.

TWO PORT GLASGOW SHIPYARDS, Lithgows, Limited, and William Hamilton & Company, Limited, are to be joined into one single yard, Sir William Lithgow, chairman of the Lithgow group, announced at the official opening of the firm's reconstructed Kingston Yard by Mr. Ernest Marples, Minister of Transport. Giving an assurance about jobs, Sir William said: "These plans do not spell retrenchment but development. Our colleagues at Hamilton's will gradually join forces with us in the Kingston Yard on an equal basis."

THE METALLURGY DIVISION of the British Iron and Steel Research Association, Sheffield, announce a conference on "Hydrogen in Steel" to be held in Harrogate between October 11 and 13. Aspects of the problem to be considered include, the removal of hydrogen from liquid and solid steel; diffusion and solubility of hydrogen in steel; effect of hydrogen on properties of ultra-high tensile steels, and hydrogen in weld metal. Application forms may be obtained from the technical secretary of the Division at BISRA headquarters in Park Lane, London. They will be available from August 14.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, Wallsend, have received an order from the Government of Curacao for two vacuum-flash evaporators, each capable of producing 1,400,000 gall. of drinking water a day. These units, it is stated, will have a larger individual output than any evaporator so far built anywhere. The order, worth approximately £500,000, is scheduled to be delivered in less than 12 months. The consultants for the contract are Stichting Nederlands Adviesbureau Voor Ingenieurswerken in Het Buitenland, The Hague, in association with Tebodin, Advies-en-Constructionbureau NV, The Hague.

AT LAGO VERDE, near Merano, in Northern Italy, a rock-fill gravity-type dam, now under construction, will be the largest in Europe, when it is completed in 1963/64. All compressed-air drilling equipment being used by the contractors, Societa Italiano Lavori, on this project was manufactured by Holman Brothers, Limited, at Camborne, Cornwall, and supplied by their Italian agents, Dott. Ing. A. Scalfi, of Milan. Climatic conditions on this site are severe for most of the year, temperatures of minus 30 degrees centigrade, and a snow level of five metres are common in the winter months. Work is only possible for about 100 days in the year.

HENRY SIMON ENGINEERING COMPANY, LIMITED, are installing new plant at the Earlestown works of their subsidiary company, T. & T. Vicars, Limited, for the production of large web-processing machines. They recently concluded a licence agreement with the Midland Ross Corporation of Cleveland, United States, by which they manufacture the American company's Waldson range of equipment and market it in Europe and the Commonwealth. The firm has already received inquiries in this connection from Russia and satellite countries. The initial expenditure is over £200,000 on machine tooling, patterns and components. It is hoped deliveries will start next year. Vicars' traditional line of manufacture is not affected by the new development.

THE COUNCIL for the Conservation of Sheffield Antiquities has almost completed restoration work on the centuries-old Shepherd Wheel in Whiteley Wood and it is expected to be working again in a few weeks' time. It is 20 years since it was last worked for demonstration purposes and 30 years since it functioned industrially. The last work has been the recogging of the main crown wheel. The Antiquities Council are also submitting a detailed plan for the restoration of the Sheffield Abbeydale Works as an industrial museum. It is understood that a £500 Ministry of Works grant for first-aid and £3,000 towards cost of restoration will be made available to the Council. A further £6,000 at least will be needed before much progress can be made.

NEW ENGINEERING LABORATORIES, which are to be built by British Railways at Derby at a cost of about £1,250,000, will be equipped with the most advanced apparatus in Britain for testing carriage and wagon underframes, bridge sections, reinforced concrete units, and other heavy-railway equipment. Building is expected to begin in August and will take about two years to complete. This project is part of a comprehensive scheme to reorganize and expand British Railways Research Department. Under the scheme, the engineering, vehicles and track, metallurgy, and physics divisions are being combined and will be housed in the new buildings at Derby which will also become the headquarters of the director of research, whose present office is in London.

LEYLAND MOTORS, LIMITED, Lancs, are introducing a commercial apprenticeship scheme which has been devised by Mr. S. Baybutt, director and chief accountant, in order to meet the ever-increasing demand for highly-trained commercial executives in the organization. In accordance with the firm's tradition of encouraging promotion within the company there will be provided a wide range of training for boys and, later, business management techniques. The company is inviting applications from prospective apprentices, who at the age of 16 should have passed the General Certificate of Education at "O" level in four subjects including English and mathematics. Applicants will be interviewed by a selection committee and the successful ones will start a course in September.

CONCERN THAT THE RATIO of six unemployed people in Sheffield have nine vacant jobs waiting for them is expressed in the magazine, *Quality*, of the Sheffield Chamber of Commerce. It is feared that this may have an effect on industrial progress. The position in the city has been for a long time that there were seven vacancies for every six people unemployed. Now the ratio has risen, with a total number of vacancies of 2,183—the highest for five years, and a total of 1,512 unemployed in May—a reduction of 66 on April. The chief vacancies are, steel 1,461; engineering 269; handtools 102; cutlery 80; building 199, and retail distribution 247. The magazine points out that the recently-published figures of the Iron and Steel Board show that the average weekly output of steel ingots and castings in the Sheffield region was 57,600 tons. This compares with 60,200 tons for the same period in 1960. It is commented, "Having in mind the very active state of the steel industry in the district, this comparative fall may surprise but seems to be due to a combination of Easter holidays and the effects of the recession in the motor-car industry."

Obituary

Mr. JOHN TEDD, export sales manager of the Distillers Company, Limited, chemical division, died on June 27 after a long illness. He was 44 years of age.

Mr. MATTHEW MACFARLANE, formerly sales manager (technical) of Glenfield & Kennedy, Limited, died in Edinburgh on June 4. He retired last October after 53 years' service with the company.

The death has occurred in London at the age of 87 of Mr. FRANCIS HILL-COLE, a director of several companies and former chairman of the Wombwell Foundry & Engineering Company, Limited.

Mr. GEORGE CRESSWELL, shop superintendent at Markham & Company, Limited, engineers, Chesterfield, for 34 years until retirement in 1954, has died aged 76. He was awarded the BEM in 1955 for his service to the staff and public. Mr. Cresswell was a founder member and honorary treasurer of the Chesterfield and District Foremen's Association.

Company News

Balfour/Darwins Merger Proposal

A merger is proposed between the two Sheffield groups, Arthur Balfour & Company, Limited, and Darwins Group, Limited, both of which are engaged in the manufacture of high-grade steels, through the formation of a holding company, Balfour & Darwins, Limited. The combined assets of the two groups amount to about £6,500,000. A one-for-10 scrip issue in ordinary is proposed by Arthur Balfour, after which a straight exchange is offered holders of both companies into the new holding company.

The scrip issue will raise Balfour's issued capital to £1,045,981, all in ordinary 10s. shares. Darwins has in issue 450,000 6 per cent. cumulative preference £1 shares and 2,007,500 Ordinary 10s. shares. The offers will be conditional on 90 per cent. acceptance and approval of the Balfour scrip issue on July 14.

With a view to equalizing dividend distribution, it is proposed that on the offers becoming unconditional each company will pay an interim dividend of 6 per cent. The Balfour interim will be on the capital to be increased by the scrip issue. Balfour & Darwins will acquire the capital of the two companies at June 30, 1961, subject to ordinary holders retaining the interim dividends.

Board Structure

The directors of both companies are of the opinion that the merger should bring substantial advantages as the two businesses are largely complementary. Apart from immediate and long-term advantages, the merger will give Darwins access to the world export sales organization built up by Balfour. The management structure of both companies will be retained.

Mr. F. Thompson-Schwab, chairman of Darwins, will be chairman of the new company, and Lord Riverdale, chairman of Balfour, will be deputy chairman, with Mr. Mark Balfour as managing director. Lord Riverdale is relinquishing his appointment as managing director of Arthur Balfour, but is retaining the position of chairman and will in future be designated executive chairman. At the same time, Mr. Balfour and Mr. L. Wright, who are at present assistant managing directors, are being appointed managing directors.

HEPWORTH IRON COMPANY, LIMITED—The company has acquired for cash over 75 per cent. of the issued share capital of Labrecque Engineering Company, Limited.

BRITISH GLUES & CHEMICALS, LIMITED, London, W.C.2—Net profit is up to £311,219 (£252,905), after tax of £147,000 (£132,000) and the dividend is maintained at 22½ per cent. with a final of 17½ per cent.

WATSON, LAIDLAW & COMPANY, LIMITED, manufacturers of sugar and laundry machinery, iron and non-ferrous founders, etc., of Glasgow—The company incurred a loss of £10,352 for the year to March 31, 1961, against a net profit of £18,726 previously, and the dividend is halved to 5 per cent.

ALLIED IRONFOUNDERS, LIMITED—In the year ended April 1, 1961, group sales showed a significant increase without taking into account the turnover of recently-acquired companies, but increased costs reduced profit margins. The market for central-heating boilers continues to develop and a new sales division has been formed to exploit it to the best advantage.

SPEAR & JACKSON, LIMITED, toolmakers, etc., of Sheffield—Payment of a final dividend of 12½ per cent. brings the total for the year to December 31, 1960, to 17½ per cent. which is effectively just over 2 per cent. higher than the previous year allowing for the increase in capital on the acquisition of the Brades, Limited, group. Net profit was £163,982 (£211,115), after tax of £188,932 (£156,208).

TRIPLEX FOUNDRIES GROUP, LIMITED—In his annual statement, the chairman and managing director, Mr. W. H. L. Harrison marks the silver jubilee of the company by giving a brief resume of changes undergone over the past 25 years. Looking to the future, he states that the group "is nicely placed for business with due regard being paid to changing trends." Profit for the year, after taxation rose to £158,689 (£105,376).

S. RUSSELL & SONS, LIMITED, mechanical and structural engineers, of Leicester—Profit for the year to March 31, 1961, was a record at £200,171 (£158,089). A final dividend of 10 per cent. makes a total of 15 (12½) per cent. The foundries have been working to capacity for most of the year and, states the chairman, Mr. George Russell, it has been and still is, difficult to meet the demand for most types of castings, particularly s.-g. iron.

GEO. W. KING, LIMITED, mechanical-handling equipment engineers and manufacturers, of Stevenage (Herts)—Mr. Donald M. King (chairman), told the annual meeting last week that of the firm's "very satisfactory" order-book, direct export work, including letters of intent, amounted to half. The company proposes a rights issue to existing shareholders of 816,000 ordinary shares of 5s. each at 12s. 6d. per share in the proportion of one-for-three.

A. REYROLLE & COMPANY, LIMITED, electrical engineers and switchgear manufacturers, of Hebburn (Co. Durham)—The company has declared unconditional its recent offer to holders of Nalder Bros. & Thompson, Limited, to acquire the 109,500 ordinary shares not already owned by Reyrolle and the 15,000 8 per cent. preference. Acceptances have been received in respect of all the shares. It is intended that the Nalder business will be continued on similar lines as before.

HERBERT TERRY & SONS, LIMITED, manufacturers of springs, etc., of Redditch (Worcs)—After tax of £77,236 net profit for the year 1960 is £151,810 (£141,032). A final dividend of 7½d. per share on the ordinary and the "A" ordinary shares is recommended making 10½d. per 5s. share (same), or 17½ per cent. for the year. Production in the current year is well maintained and steps are being taken to secure additional manufacturing facilities at Plymouth, says the chairman, Mr. Norman V. Terry.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, electrical and general engineers, boilermakers and ironfounders etc., of Wallsend-on-Tyne—Group profits, before tax, fell to £128,042 (£516,900) for the year to April 1, 1961. There is no dividend, against 10d. per 10s. share previously, but a tax-free capital distribution of 1½d. per share is proposed out of capital reserves. Directors state that this further reduction in profits is due to continuing excess capacity and severe competition in the marine-engineering and power-plant industries in which the group is primarily engaged. In consequence, it is still necessary to take contracts at uneconomical prices.

PLANS for a £95,000 part of Ayr's new technical college have been approved by Ayr Dean of Guild Court. When completed, the college, which will be sited at Dam Park, will cost a total of £800,000.

Raw Material Markets

Iron and Steel

Demands from the iron foundries for supplies of all grades of pig-iron continue steady and producers are able to deal comfortably with these requirements. There is little forward buying and orders are mainly for current consumption and working stock. The engineering and speciality foundries maintain their supremacy in the call for pig-iron supplies, and their usage of the low phosphorus irons, hematite and the refined irons is at fairly substantial levels.

From the several blast furnaces now providing the low phosphorus irons, which are chiefly in demand for the production of high quality castings, overall outputs keep the foundries well supplied and no difficulty is experienced in obtaining their requirements, although one or two brands are not so plentiful as other irons. Hematite and refined irons are delivered to requirements.

The high phosphorus irons used by the light, jobbing, textile and some of the engineering foundries are available in more than sufficient quantities and producers are happy to dispose of excess tonnage to overseas buyers as and when orders can be obtained. The steelworks are also well covered for their needs of basic pig-iron which comprise the major portion of outputs, and additional capacity is available to satisfy an increased usage of this iron.

Substantial quantities of high duty castings are being supplied by the engineering and speciality foundries to many trades and most of these foundries are operating on a normal five-day week. Many of the light foundries continue to work on a moderate scale, and business is slow for those units providing castings for domestic utensils. The foundries supplying castings to the building trades are reasonably well employed. The jobbing and textile foundries could undertake much more work than is forthcoming.

The foundries are taking up all arisings of the better and heavier grades of cast-iron scrap, and are fairly well provided with their needs. Foundry coke deliveries are coming forward satisfactorily and ganister, limestone, and firebricks are in good supply.

The re-rollers generally are striving to improve on their meagre order-books for small bars, light sections, strip, etc. Business available continues to decline, and in many instances this is insufficient to make up full rolling tonnages. The re-rollers of reinforcing rods and bars are better placed, as the demand for these continues heavy.

The re-rollers are well provided with supplies of mild steel semis. Apart from the stocks held by them, home steelworks can satisfy present needs easily and could cope with a much larger demand. The units requiring alloy and carbon steels are also able to obtain their needs. Arisings at the steelworks of suitable re-rolling defectives and crops are readily accepted by the re-rollers.

Non-ferrous Metals

Tin has suffered the inevitable setback which invariably comes when the price "runs away." The underlying causes of the reversal in the price trend are three. First, the news from America that the US State Department was on the verge of releasing some 4,000 tons of tin from its stockpile; Malayan production of tin in May showed an increase of 7 per cent. over April and at 4,745 tons was the highest monthly production since December, 1957; and, finally, news from the Congo that the tin mines were in full production and have been since independence. If this is true the tin produced has been stockpiled awaiting transport facilities, and that when they are available, tin supplies from this source will relieve the immediate pressure on the market. However, when the supply/demand situation was being assessed, production from the Congo was taken into consideration and there was still a deficit of supply in relation to demand of the order of 15,000 tons.

The outlook is unclear and, depending on what is agreed this week by the International Tin Council dealers and fabricators will determine what they will do with the stocks of metal they have on their hands over and above their short-term commitments. The market in the East continues strong but is showing more sensitivity than before. In the US the market, though steady, is also sensitive and the price has come down to around $1.6 a pound.

Copper has been relatively dull on both sides of the Atlantic. The wage-packet deal of an increase of 10 cents an hour offered by Kennecott to its workers made for a firmer market in the US than in London as the American metal market took the view that it would be rejected. In London, this view was not strongly held and the price is shaky around £233-£235 a ton. In the US the price for both producers and custom smelters is unchanged at 31 cents a pound.

Zinc is a firmer market in New York than in London. This is due to the hope that the US Government will sell surplus farm produce abroad and with the $60,000,000 proceeds buy up lead and zinc. This money is estimated to be sufficient to buy 300,000 tons which is about equal to the US stocks overhanging the market. New York is also stronger because consumption has shown an improvement in each of the last three months. The US price is, therefore, steady at 11½ cents a pound. However, London feels somewhat differently as the market is only fair and stocks both here and on the Continent are a depressing influence. The UK price is fluctuating narrowly around £78 a ton.

Lead, like zinc, is stronger in New York than in London due to the proposed barter deal and the price is unchanged at 11 cents a pound. In London, the market is weak and sensitive and the price is struggling to hold the line around £65 a ton.

Publications Received

Baker Perkins—Its Growth as a Group. Issued by Baker Perkins, Limited, Westwood Works, Peterborough.

Both the original Mr. Baker and Mr. Perkins came from the other side of the Atlantic, the former from Canada and the latter was born in Massachusetts in 1766, coming to London in 1819. A century went by before the enterprises started by these two pioneers were amalgamated. This brochure illustrated in colour, describes in detail the growth of the Baker Perkins group and its very diverse activities, which now include the manufacture of foundry equipment.

Library Guide to Selected Publications of the Grant-aided Research Associations. Published by the Department of Scientific and Industrial Research, Charles House, 5-11, Regent Street, London, S.W.1.

This Guide lists and prices a large number of publications, now available to non-members, of the various grant-aided research associations, of which there are just over 50. It is a useful list to have in one's book-case.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated. In accordance with Iron and Steel Board Price Determination, 1961, No. 2, the prices of products listed below coming under the board's control are increased by 1 per cent.)

July 5, 1961

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over, Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham; £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £45 0s. 0d. to £48 0s. 0d., scale 15s. 0d. per unit, lumpy, 75 per cent. Si, £62 0s. 0d. to £66 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s.10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 10s. 3d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 13s. 3d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr.; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent. Cb + Ta, 19s. 0d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £58 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons and over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons and over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C; £40 11s. 0d.; silico-manganese, £43 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

* Average 68-70 per cent.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £231 10s. 0d. to £231 15s. 0d.; three months, £235 5s. 0d. to £235 10s. 0d.; settlement, £231 15s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 3½d. per lb.; rods, 251s. 6d. per cwt. basis; 20 s.w.g., 286s. 6d. per cwt.

Tin.—Cash, £921 0s. 0d. to £922 0s. 0d. ; three months, £926 0s. 0d. to £927 0s. 0d.; settlement, £922 0s. 0d.

Lead (Refined Pig).—First half July, £65 0s. 0d. to £65 5s. 0d.; first half October, £66 0s. 0d. to £66 7s. 6d. settlement, £65 5s. 0d.

Zinc.—First half July, £78 10s. 0d. to £78 12s. 6d.; first half October, £79 12s. 6d. to £79 15s. 0d.; settlement, £78 12s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £115 17s. 6d.; rolled zinc (boiler plates), all English destinations, £113 12s. 6d.; zinc oxide (Red Seal); d/d buyers' premises, £95 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10½d. per lb.; sheets to 10 w.g., 202s. 6d. per cwt.; wire, 2s. 8½d.; rolled metal, 202s. 6d. per cwt.

Brass (Brazing).—BS1400, B3, £176; B6, £223.

Brass (High Tensile).—BS1400, HTB1, £195; HTB2, £215; HTB3, £231.

Gunmetal.—BS1400, LG2, £219; LG3, £229; G1, ½%, £298; G1, 1%, £288.

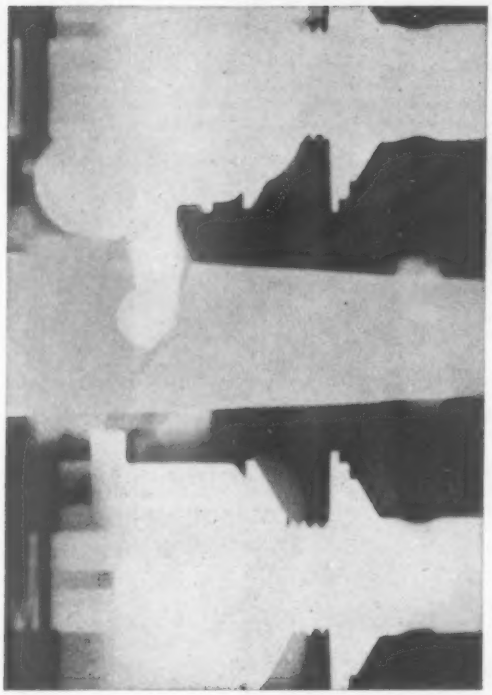
Phosphor Bronze.—BS1400, PB1 (AID released), £315; BS1400, 90/10/1, £303.

Leaded Phosphor Bronze.—BS1400, LPB1, £243.

Phosphor Bronze Strip, etc.—Strip, 305s. 6d. per cwt.; wire, 4s. 3d. per lb.; rods, 3s. 5½d.; tubes, 3s. 5½d.; chill cast bars, solids 3s. 5½d.; cored, 3s. 6½d. (CHARLES CLIFFORD LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 11d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £230 0s. 0d. Quicksilver, ex-warehouse, £66 0s. 0d. Nickel, £660 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £246; AB2, £254.



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F

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

844,189. Vallak (GB), Limited, High Furlong, Blackpool, Lancs.

Insulating lining tiles used to surround the top of an ingot casting in a chill mould. The tiles provided by this Patent can be readily inserted into the mould, and accurately fitted to the mould, and to each other.

844,757. Karl Heinz Steigerwald, Sauerbouchstrasse, 10, Heidenheim/Brenz, Germany.

A method of increasing the rate of heat transfer between a heated surface of any material and a liquid in contact therewith. The inventor claims this to have application in the casting of metals in which the objective is to cool the metal rapidly. An electric voltage is applied between the liquid and the heated surface of sufficient magnitude as to produce an electrical discharge throughout the vapour film.

844,993. General Motors Corporation, Grand Boulevard, Detroit, Michigan, USA.

Improved moulds for casting metals by the use of which large castings, such as dies for forging automobile-engine connecting rods, may be made with a high degree of accuracy and surface finish. The process is of the shell-moulding type but avoids deformation of the mould during pouring and solidification of the metal.

Australian Patents

Photostat copies of Australian Patents are available from the UK Patent Office, price 9d. per page. The address given, unless otherwise specified, is that of the agent for service.

227,716. Mond Nickel Company, Limited., Phillips, Ormonde, Le Plastrier and Nelson, 37-41, Queen Street, Melbourne, Victoria. (5 sheets).

Nickel-iron alloys containing nickel 23 to 28, copper 6 to 11, carbon not exceeding 0.03, and silicon not exceeding 0.003 per cent. The balance, apart from impurities, is iron.

227,988. Herman Pneumatic Machine Company, Spruson and Ferguson, Caltex House, Kent Street, Sydney, New South Wales. (14 sheets).

Squeezing mould forming machine. Means are included for supporting a pattern with an open-topped flask mounted on it. Finely-divided mould-forming material in the flask is squeezed by a number of members carried by a head for generally side-by-side vertically downward movement into the open top of the flask. These squeezing members are operable separately so that they may move downwards to different extents—whereby promoting the desired distribution and compression of the mould-forming material in the flask.

228,442. International Harvester Company, Edward Waters and Sons, 422, 428, Collins Street, Melbourne, Victoria. (20 sheets).

Ductile-iron castings. These are free, in the as-cast condition, of carbon agglomerated substantially in nodular form dispersed in the matrix. A molten-iron mix of hypereutectic composition is established containing sulphur not exceeding 0.03 per cent. (If this were then cast it would result in cast iron containing free carbon in flake form dispersed in the matrix). Introduced into this mix, then, is at least one nodular carbon impelling agent, selected from the group—lanthanum, sararium, praseodymium, and neodymium—in sufficient quantity so that from 0.02 to 1 per cent. by weight is retained in the casting.

228,828. Foundry Flux, Limited., A. W. Smith, 358, Collins Street, Melbourne, Victoria. (8 sheets).

De-gassing agent for treating molten aluminium or magnesium alloys. The agent, which has a greater specific gravity than the molten metal, is intermixed in powdered form with granulated copper, nickel, or manganese having a content of phosphorus, and compressed into tablet form. The phosphorus causes the copper, nickel or manganese to gradually disperse in the molten alloy. Substances for grain refining or adding gas to aluminium or magnesium alloys, and substances for degassing magnesium alloys are also claimed in this Patent.

Belgian Patents

Photo copies of the Patents, from which these abstracts are taken, can be obtained from the UK Patent Office at 9d. per page.

581,213. British Iron and Steel Research Association, 11, Park Lane, London, W.1. (7 sheets).

Improvements in continuous-casting processes. The apparatus consists of a device activated by fluid to which the mould is coupled, and a control device to regulate the flow of fluid under pressure, thereby propelling the mould in a longitudinal direction back and forth at regular intervals in such a way as to stop or prevent the sticking of the ingot to the mould.

581,601. Stoecker and Kunz, G.m.b.H., Ohlensorffstrasse 30, Krefeld, Linn, Rheinhafen, Germany. (5 sheets).

Ceramic refractory-tube for casting molten metals. The tube consists of an inner ceramic tube concentrically surrounded by ceramic refractory-tubing, with a metal skin between the two tubes.

581,993. United States Steel Corporation, 525, William Penn Place, Pittsburgh, 30, Penna., USA. (10 sheets).

A valve seating for an apparatus for the casting of metals under vacuum. The device, at the lower end of a valve seating, consists of a fixed part and a removable part, the arrangement being such that the valve forms a vacuum seal between the opening and the vessel. There is also a device to operate the moving part of the valve to the open position, thus establishing an evacuation connection between the opening and the vessel.

582,036. Enn Vallak, 26, Avenue Krieg, Geneva, Switzerland.

A hot-top for foundry moulds. This consists principally of combustible additives likely to oxidize the gases of combustion and to generate carbon dioxide in order to lessen the carbonizing effect of the gases on the cast metal.

582,188. Enfield Rolling Mills, Limited., Brimsdown, Enfield, Middlesex.

Water-cooled mould for use in casting metals. The mould consists of a refractory body with a mould cavity, and passages for cooling water formed by a number of holes of tapering cross-section, extending through the body of the mould. These holes are lined with metal tubes also of tapering cross-section similar to that of the holes in the mould body. The smaller ends of the tubes are anchored relative to the mould body. This Patent corresponds to British Patent 857,237, to be abstracted later.

Photo by courtesy of Fibres Division, Imperial Chemical Industries Ltd. Manufacturers of 'Terylene' polyester fibre.

C IS FOR CONVEYOR BELTS at a new I.C.I. plant in Cheshire, where eight Goodyear belts of rubber and 'Terylene' carry coke, burnt lime and coke/lime mixture. 'Terylene' was chosen for its flexibility and strength, which allows exceptionally deep troughing so that deck plates, skirt boards, etc., are eliminated and idlers can be spaced 50% wider apart. 'Terylene' also withstands the heat of the coke (carried at up to 120°C), is rotproof and resists moisture penetration. For the *right* conveyor belt, installed in the *right* way and maintained in the *right* manner, contact Goodyear Industrial Products Division at Wolverhampton.

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The Goodyear Tyre & Rubber Co. (G.B.) Ltd., Industrial Products Dept., Wolverhampton. Export Enquiries: 17 Stratton Street, London W.1

Pig-iron and Steel Production

Statistical Summary of April, 1961 Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table 1 summarizes activities during recent months. Table 2 gives production of steel ingots and castings in April. Table 3, weekly average production of finished steel in March. Table 4 gives the production of pig-iron and ferro-alloys in April, and furnaces in blast. (All figures are weekly averages in thousands of tons).

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	Iron and steel.	Coal.[1]	Basic materials[2]						Imports.[3]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[4]
1959	340	496	477	286	244	210	242	208	7	388	291	2,244
1960	339	505	482	329	319	264	303	243	24	467	361	2,702
1961—Jan. ..	339	538	472	351	327	272	308	248	14	478	364	2,739
Feb. ..	339	538	476	354	325	265	302	254	11	485	365	2,783
Mar.[5]	339	538	480	351	322	264	313	248	11	471	356	2,779
April	339	538	480	313	322	261	308	244	6	472	357	2,744

TABLE 2.—*Average Weekly Production of Steel Ingots and Castings in April.*

District.	Open-hearth.		Bessemer and LD.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Steel for castings.	
Derbys, Leics, Notts, Northants, and Essex ..	—	3.4	15.0 (basic)	2.7	0.1	19.7	1.5	21.2
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches	1.5	38.2	—	5.4	0.4	44.1	1.4	44.2
Yorkshire (excl. N.-E. Coast and Sheffield) ..								1.3
Lincolnshire	—	51.6	—	—	0.1	51.6	0.1	51.7
North-East Coast	0.8	96.2	—	1.8	0.4	97.1	2.1	99.2
Scotland	1.2	47.1	—	4.2	—	50.2	2.3	52.5
Staffs, Shrops, Worcs, and Warwicks	—	27.0	—	4.7	0.7	30.0	1.8	32.4
South Wales and Monmouthshire	1.3	84.0	19.8 (basic)	0.7	0.1	105.5	0.4	105.9
Sheffield (incl. small tonnage in Manchester) ..	7.0	37.4	—	12.9	0.3	55.8	1.8	57.6
North-West Coast	—	—	4.9 (acid)	0.7	—	5.6	0.1	5.6
Total	11.8	384.9	39.7	33.1	2.1	460.1	11.5	471.6
March, 1961[5]	12.7	382.5	38.5	34.9	2.4	458.5	12.5	471.0
April, 1960	11.4	394.9	37.7	32.1	2.0	467.5	10.6	478.1

TABLE 3.—*Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1959.	1960.	1960.	1961.	
			March.[5]	Feb.	March.[5]
Non-alloy Steel:					
Ingots, blooms, billets, and slabs[6]	5.1	5.6	5.9	6.7	6.8
Heavy rails ..	6.8	8.7	10.0	9.6	9.2
Sleepers	0.6	0.8	0.5	1.3	1.0
Fish and soleplates	0.4	0.6	0.6	0.8	0.7
Plates, 3 mm. thick and over ..	43.1	52.9	54.5	64.5	63.3
Other heavy prods.	41.2	53.1	56.3	57.7	60.3
Ferro-concrete bars	9.6	12.0	12.7	12.8	14.6
Wire rods	23.5	28.6	29.9	28.3	27.7
Arches, etc. ..	7.8	7.9	8.5	8.1	7.4
Other light sections	33.0	41.3	45.6	46.2	40.8
Bright steel bars ..	7.6	9.7	10.3	9.3	9.5
Hot-rolled strip ..	27.4	33.1	35.3	29.4	28.2
Cold-rolled strip ..	8.0	10.0	10.6	9.6	9.1
Sheets, incl. coated	47.0	53.5	57.4	49.1	47.8
Tinplate	20.9	22.4	24.7	21.4	21.0
Blackplate ..	0.7	0.9	1.0	0.8	0.7
Tubes up to 16 in.	20.6	23.8	24.5	21.8	22.6
Tube fittings, etc. ..	0.4	0.4	0.4	0.4	0.4
Tyres, wheels, axles	2.4	2.4	2.8	2.6	2.3
Forgings (excl. drop)	2.1	2.2	2.2	2.5	2.2
Steel castings ..	3.6	4.3	4.3	4.7	4.8
Tool steel	0.2	0.2	0.2	0.2	0.3
Total	312.0	374.4	398.2	387.8	380.7
Alloy steel	18.2	22.5	23.2	23.4	23.1
Total deliveries from UK production[7]	330.2	396.9	421.4	411.2	403.8
Add: Imported finished steel ..	7.1	19.1	15.2	7.1	5.8
	337.3	416.0	436.6	418.3	409.6
Deduct: Intra-industry conversion[8]	47.6	56.4	61.4	54.2	53.9
Total new material ..	289.7	359.6	375.2	364.1	355.7

TABLE 4.—*Production of Pig-iron and Ferro-alloys.*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.
Derbys, Leics, Notts, Northants, and Essex	20	—	27.4	19.8	—	47.2
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches ..	8	—	24.3	—	1.9	26.2
Yorkshire (excl. N.-E. Coast and Sheffield)	—	—	—	—	—	—
Lincolnshire	10	—	48.2	—	—	48.2
North-East Coast ..	16	2.5	63.8	—	—	66.3
Scotland	7	1.1	25.4	1.2	—	27.7
Staffs, Shrops, Worcs, and Warwicks ..	5	—	10.7	1.0	—	11.7
South Wales and Monmouthshire	10	2.6	56.3	1.3	—	60.2
Sheffield	2	—	3.5	—	—	3.5
North-West Coast ..	8	15.1	—	1.0	1.3	17.4
Total	86	21.3	259.6	24.3	3.2	308.4
March, 1961[5]	86	23.9	262.6	23.6	3.4	313.5
April, 1960	86	26.4	252.5	28.0	3.7	310.6

[1] The index for coal is now based on prices ruling on the last day of each month.

[2] Used in non-food manufacturing industries.

[3] Weekly average of calendar month.

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Baker Perkins Foundry Machinery at work.....

at R. & A. Main Ltd.

R. & A. Main Ltd. use this 'Medium' Rotary Table Shot Blast Machine for a wide range of application at a high production rate. The special control desk includes signal lights, 24 volt current socket for inspection and ammeters indicating the shot output of the patented bi-phase impellers. The wiring circuit is arranged for automatic operation to cut out human errors.

Please write for further details to:

Baker Perkins Ltd *Foundry Machinery Division*

Bedewell Works · Hebburn on Tyne · England *Tel: Jarrow 897124* BP/F2

HISTORICAL NOTE

R. & A. Main Ltd. were established in Glasgow in the 1870's. Following the amalgamation with Thomas Glover & Co. Ltd. in 1897, extensive sites were acquired at Edmonton and Falkirk. They produce a wide range of domestic appliances including the 'Century' gas cooker, the 'Century' gas heater and the Main No. 36.c. Refrigerator — the first to carry a ten year guarantee.

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PREPAID RATES: **Twenty words for 10/- (minimum charge) and 4d. per word thereafter. Box numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

AUSTRALIAN (40), M.I.B.F., settling in U.K., seeks executive position with progressive foundry; experience from jobbing moulder to works manager. Ferrous castings to 20 tons, also non-ferrous. Past seven years executive position. Capable of supervising installation of new plant, and taking complete charge. Box AF825, FOUNDRY TRADE JOURNAL.

IRON FOUNDRY TECHNICIAN, metallurgist, desires executive position with small to medium foundry, Wolverhampton, Walsall, Birmingham district. Box IF835, FOUNDRY TRADE JOURNAL.

IRON FOUNDRY METALLURGIST TECHNICIAN (29) seeks position technical representative preferably Midlands, but any area considered. Box IF827, FOUNDRY TRADE JOURNAL.

YOUNG EXECUTIVE (30), chief metallurgist blackheart malleable firm, hot-blast annealing, sand control, shell, CO_2, costing, nine years in grey iron, seeks position with Midland Foundry. Box YE828, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

FOUNDRY FOREMAN, Assistant to Manager, required for Grey Iron Foundry in Birmingham Area. Young man aged 25-30 preferred. Applicants must have received thorough practical training in jobbing and batch production of Iron Castings up to 4-5 cwts. Previous experience in handling personnel of definite advantage. Permanent position for man with enthusiasm and ability. Apply Box FF830, FOUNDRY TRADE JOURNAL.

GENERAL WORKS MANAGER required for Midlands area. Must have several years' experience in a General Foundry, also be fully conversant with Machine Shop production. Positions held should include those at works management level. H.N.C. or equivalent in Mechanical Engineering essential. Age 35/45. Appropriate salary and benefits. Box GW832, FOUNDRY TRADE JOURNAL.

SENIOR METHODS ENGINEER

Applications are invited for the position of Senior Methods Engineer with a leading South Wales Steel Foundry. Knowledge of piecework, rate fixing and estimating would be an advantage. The company operates a staff superannuation scheme. This is a staff appointment. The salary will depend upon age and experience. Replies, which will be treated in confidence, and should give full details of age, experience and qualifications, to:

Works Manager, Brown, Lenox & Co. Ltd., Pontypridd, Glamorgan

SITUATIONS VACANT—*contd.*

Baker Perkins Ltd

employs 8,500 people in 14 different companies in the United Kingdom alone and now stands foremost in the world in the manufacture of a range of industrial equipment which includes large automatic bread and biscuit bakeries, chocolate and confectionery making plant and wrapping machinery.

A vacancy has occurred in the Foundry at the Peterborough works for the position of

DEPUTY FOUNDRY SUPERINTENDENT

To fill this vacancy we are looking for a man who will fit the following specification:

Qualifications: A minimum of City & Guilds certificate in Foundry Practice, but a Diploma in Foundry Technology would be desirable.

Experience: Must have had practical experience of moulding, both on iron and steel castings but with a preference for steel. A good metallurgical background is required and a knowledge of electric melting and cupola practice is essential.

Responsibilities: He will be responsible to the Foundry Superintendent and will be expected to take charge of the Steel and Alloy Cast Iron Section of the Foundry to ensure the production of good quality castings in a variety of grades and specifications.

Age Range: Preferably between 28 and 35 years of age.

Conditions of employment accord with the best modern practices and include profit sharing, pension and life assurance schemes, after qualifying service.

Write for application form to Assistant Personnel Manager, Baker Perkins Limited, Peterborough.

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Specifications, etc., relative to the above tender enquiry can be obtained from the Co-ordinations Branch, India Store Department, Bromyard Avenue, Acton, W.3, at a cost of £3 15s. per set. The cost of the tender document is not refundable. Tenders are to be returned direct to the GENERAL MANAGER, INDIAN RAILWAYS, Chittaranjan Locomotive Works, Chittaranjan, West Bengal, India, so as to reach him by 5.30 p.m. on 12th October, 1961.

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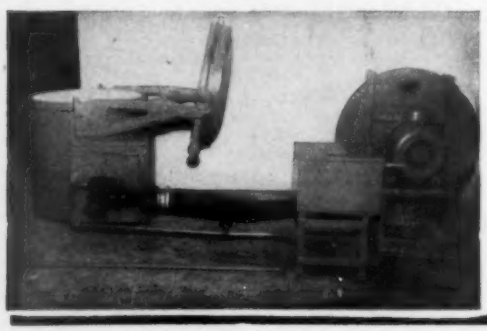

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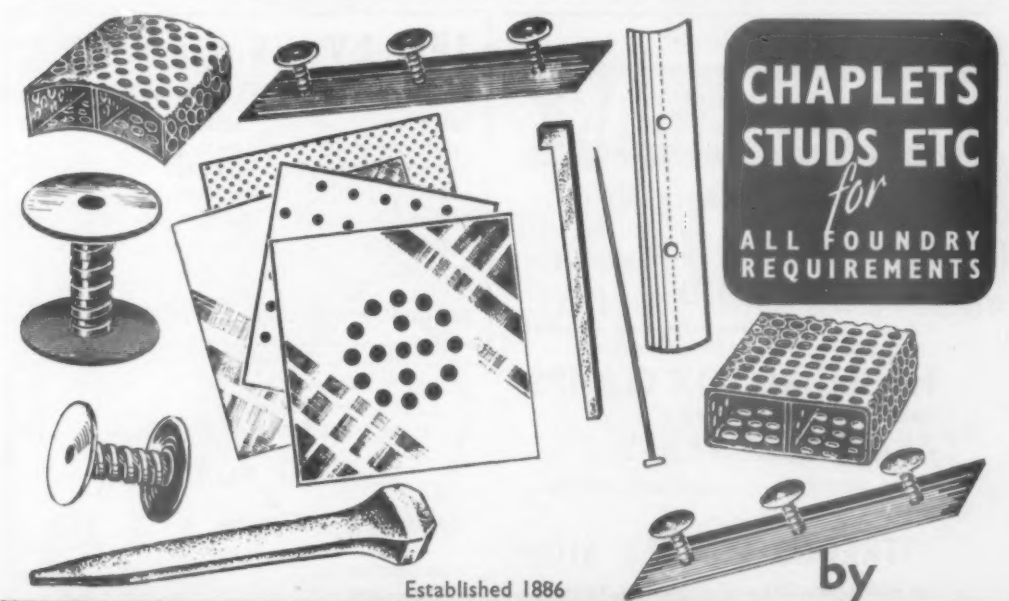

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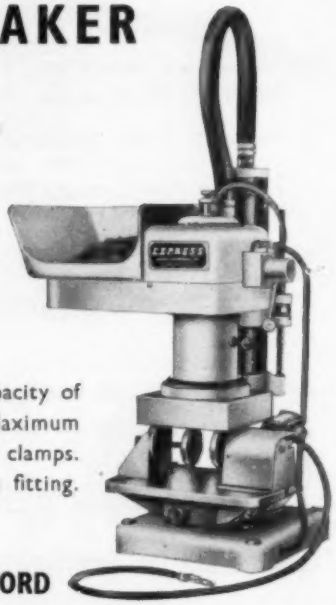

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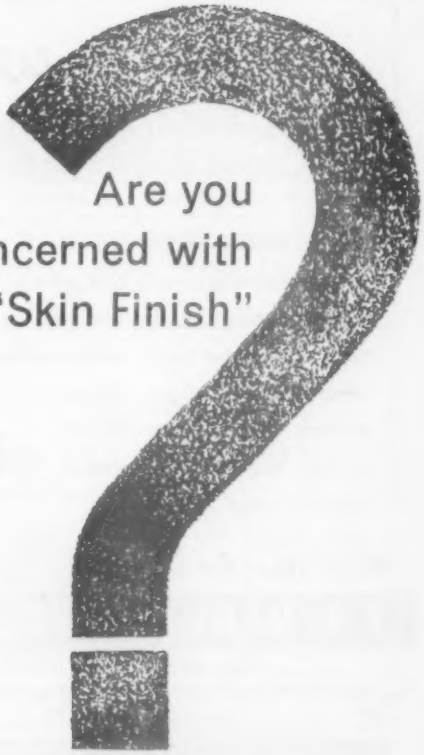

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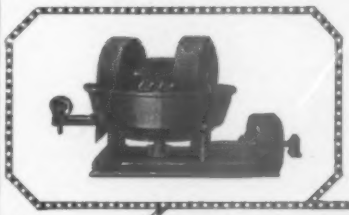

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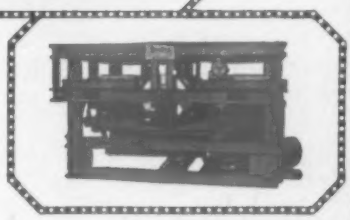

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